

High-Performance Computing for High-Value Weather Forecasts



Organizations

Aslogic is a Spanish Engineering SME that develops and co-creates solutions for highly efficient and safe air traffic management.

University of Leon is an expert in developing numerical weather forecast models for the aeronautical sector. It has been a technology supplier for the Spanish National Institute of Aeronautical Technology for over 25 years.

CESGA is a public foundation that provides HPC services for R&D, supporting SMEs to leverage their competitiveness through the usage of HPC.

End User



Domain Expert



HPC Centre & Provider



Partner CESGA is part of the NCC Spain.



The Challenge

Currently, aeronautical meteorological information is focused on providing the meteorological conditions at departure and arrival airports. Although this is sufficient for conventional aviation, it is not enough for Unmanned Aerial Vehicles (UAVs, so-called 'drones'). Due to their size and flying dynamics, drones are more vulnerable to their surroundings. Hence, one of the main factors to be considered in the operational safety of drones is accurate and reliable weather forecasting throughout the flight path. This is difficult to achieve as:

- drones do not start or finish their missions from fixed points such as airports and thus cannot rely on fixed ground infrastructure, which leads to a lack of real-time meteorological data for specific locations.
- the airworthiness characteristics of drones make them more sensitive to adverse weather such as icing or strong winds.

Moreover, it is expected that in the future, most flights will be out of sight of the pilot and autonomous, thereby being unable to rely on human operators for correcting the planned trajectory in adverse weather situations.



Wind

Data logger

Pressure

Temperature

Dew point
characterization



Industry Sector
Transportation

Technology used:
HPC

The Solution

The HERCULES experiment addressed the challenge of creating reliable weather forecasts appropriate for drones without expensive ground equipment. Meteodrone - a UAV that characterizes and safely flies in all atmospheric conditions thanks to a set of onboard sensors - collected weather information during 150 flights over key locations in Galicia to provide the necessary data for the building of the forecast models.

Furthermore, 4 different parametrized Weather Research and Forecasting (WRF) models were provisioned to provide accurate weather prediction in the region of Galicia with a horizontal resolution of 3 km at different altitudes. The use of HPC resources shortened the execution time for weather model parametrization and reduced the development time of the weather service.

Lastly, tools and services through the newly developed HERCULES website will be provisioned. Customers will define the area in which the flights will be executed and recover the relevant weather information report for their missions.

The Impact

HERCULES' solution will enable safe and efficient drone operations by providing operators the capability to obtain dedicated weather forecasts at their flying altitudes without relying on expensive ground infrastructure. This service will be one of the keys to unlocking an emerging sector that is expected to grow by €10 billion annually until 2035. In addition, the live information provided by the Meteodrone could be used to support traditional manned aviation during landing procedures in aerodromes that cannot use ground infrastructure for weather predictions. HERCULES high-resolution local weather forecast models have the potential for future business opportunities in other industries - for example, wind energy or fishing in which accurate weather prediction could positively impact safety and efficiency.

Benefits

- High-resolution weather forecast without relying on ground infrastructure (saving €100,000) and providing capabilities to characterize atmospheric conditions at any location.
- A weather forecast optimised for UAVs that can increase operational efficiency and safety thanks to the collection of weather forecast information at low altitudes (10, 20, 50 and 125 meters) and with high horizontal resolution.
- With a pricing policy based on an annual subscription (€30/€60 for premium services) HERCULES could reach 2.000 pilots/users in the next 3 years with an expected turnover of €78,000 per year for Aslogic.