

# **Ayuda a la planificación de los vuelos con “unmanned aerial systems” (UAS) a partir de modelos de predicción meteorológicos específicos**

## **Support for planning unmanned aerial systems (UAS) flights based on specific weather forecast models**

J.L. Sánchez, G. Mérida, R. Weigand

GFA. IMARENA. Universidad de León

### **RESUMEN**

The use of “unmanned aerial systems” (UAS) has increased exponentially in recent years. For civil flights, regulations are issued by EASA (European Aviation Safety Agency) and each country adapts them to its needs. Flights are conducted within the first 125 meters of height, in areas far from airports, therefore within the boundary layer, and with limited meteorological information. The successive projects we have carried out since 2018 aim to create decision-making tools that determine flight risks based on the limitations of the UAS to be used, and the analysis of meteorological conditions present in the first 125 meters of altitude. We also cover the entire Iberian Peninsula and the Balearic Islands with a 3 x 3 km resolution. Since these flights are highly influenced by the characteristics of each area and change over time, it is necessary to develop specific models. To this end, we used the facilities of the Barcelona Supercomputing Center (BSC) to run 20 WRF-based parameterization combinations and evaluate them with measurements taken from a UAS 8 (called METEOUAS), equipped with specific meteorological instrumentation developed by us and with the corresponding certifications to guarantee the quality of the measurements. The results of the comparisons have shown that the meteorological models that best predict weather conditions for UAS flights in one area differ completely from those that are most suitable in others. The ultimate goal of weather prediction models is to provide users with a tool that allows them to make the best decisions for safe flight. To this end, the tool allows, for each area, the determination of

- the hourly wind speed at different levels.
- vertical profiles according to the Skew-T diagram and tri-hourly changes.

In cases where the prediction models have been fine-tuned in areas where UAS prototypes are being developed, we have achieved a prediction that, in at least 50% of cases, the wind speed uncertainty at flight levels below 125 meters is less than  $\pm 1$  m/s. For temperature, the value is  $\pm 1^\circ\text{C}$ . This allows for the planning of flight tests and the selection of the levels and time windows that best suit the needs.

*Acknowledgments:* The use of forecast models has made use of the facilities of the Barcelona Supercomputing Center (BSC). The authors thankfully acknowledge RES resources provided by BSC. We would also like to acknowledge the support of Digital Aeronautics Engineering Services in the development of the application and of Nimbux5 as the developer of the measuring instruments that have made it possible to surpass the meteorological instrumentation currently available on the market, achieving high reliability.