Complex meteorological support system for UAVs: a Hungarian statistical and numerical approach in the practice

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Abstract — The accurate, high detailed and specific meteorological information is essential for unmanned aerial operations. To avoid losses we need to reduce weather risk by a more accurate and sophisticated meteorological support of flight mission planning and execution. That was the reason of the development of a complex meteorological support system, which is able to effectively reduce the potential risk based on weather impacts of aviation. Fulfilling this requirement an Integrated Aviation Weather Prediction System (IAWPS) has been developed. An extensive technical implementation of Weather Research and Forecasting limited area model has been applied to supply operative numerical prediction information for IAWPS. Different parameterization of the model system have been investigated on 9 typical weather situations, all of them having aeronautical safety relevance from the weather hazard point of view.

The system also includes a dataset-based mission planning part, and an ultra-short term fuzzy logic based analog forecasting subsystem. This part uses fuzzy logic in searching process and Analytic Hierarchy Process (AHP) in weighting the chosen meteorological parameters. The fuzzy logic based analog forecasting subsystem find the most similar situations to the actual weather situation and it helps to give an ultra-short term forecast for the most relevant meteorological parameters. The results of the verification are convincing and help to optimize the system before operational use.

On the other hand, meteorological measurements with sensors developed especially for unmanned aerial operations have been done. This paper introduces the applicability of this numerical weather prediction system for special forecasting needs of unmanned aerial systems. Following the short introduction of the weather prediction system that was applied, results of the case study test runs are compared to both surface and spatial observations which consequently determined operative model setup and further investigations. The experiences of UAV flights are also presented.

Finally we show our developed website where the short time weather predictions are found for the UAV pilots, mission specialists and decision makers, too. We have to note our system is a very flexible and applicable everywhere in the world because we used the freely accessible meteorological data such as WRF products and METARs!

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