

A new observation data base for the verification of the icing product **SIGMA**

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The main goal of aviation forecast is to increase the pilot awareness towards the weather hazards such as icing, turbulence and convection.

On the one hand, analyse of radar or satellite imagery gives information on the convection in the atmosphere. On the other hand the turbulent conditions can be verified against the turbulence mesures collected by aircraft within the AMDAR program, which constitute a valuable observation data base. Unfortunately, over Europe, the verification of the icing products is more difficult. Airplanes are just beginning to be equipped with icing probes; those remains still scarce at the time. Thus, the only way to have information about the icing conditions is to collect the pilot reports. In USA, pilot reports (PIREP) are very common. It is not the case in Europe. For those reasons, Meteo-France has concluded an agreement with one of the main pilot school in order to collect information about their flight and then build an weather event data base. For nearly 4 years now, a form has been filled by the pilot, describing weather hazards encountered after each flight. The data are collected every day and compose a data-base of approx 14000 events (icing-no icing). This data base is a building block for the verification of Meteo-France's system for the detection of icing areas : SIGMA (System of Icing Geographic identification in Meteorology for Aviation).

SIGMA aims at identifying the areas where the meteorological conditions are prone to in-flight icing. SIGMA gives information on the icing conditions at the observation time. Depending on the weather evolution, the forecasters make use of this input for the elaboration of the Significant Weather charts (SIGWX) and the SIGMET messages, used by the airspace users.

SIGMA is based on data fusion using three different sources of data. First an icing risk index is calculated from Météo-France's numerical weather prediction (NWP) model. The satellite imagery (infra-red channel, cloud classification, clout top temperature and pressure, icing product) from the geostationary Meteosat satellite (MSG Meteosat Second Generation) gives an information on the cloud coverage. In addition the radar reflectivities issued from Météo-France's operational radar network add information about precipitation and convection.. The most relevant information for icing detection are extracted and combined together. Then SIGMA provides a real time cartography of the icing risk every 15 minutes on a domain covering France and surrounding countries. The quality of icing detection performed by the previous versions of SIGMA has been demonstrated by several evaluation and verification campaigns over Europe and USA.

The latest SIGMA algorithm uses the newly available microphysic information from Meteo-France's NWP named AROME. The liquid water content and the rain content are now inputs of the SIGMA algorithm and participates in the deduction process of icing conditions identification and in the evaluation of the icing severity.

The event data base is first characterized prior to its use in a systematic verification process. The good characterization of the data base will ease the further verification studies and improves our knowledge of the spatial and temporal distribution of icing events. Selected case studies are also presented.