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Comparative study of aircraft icing conditions using different measurements of meteorological instruments and the mesoscale model WRF

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Aircraft icing is the process where the supercooled drops present in the atmosphere (mainly in the clouds) are frozen on different surfaces of the aircraft. In aviation, this process can produce a considerable ice accumulation on airplanes, causing aerodynamic alterations, increased resistance, and a loss of power. Aircraft icing is the leading cause of aircraft accidents related to meteorology in the world, so its study is critical.
This work aims to verify if the measures of liquid water content (LWC) and temperature at different heights collected with different instruments are similar to each other, and identify the areas where aircraft icing processes are likely to occur.
In this comparative study, we have compared the results obtained from a multi-channel microwave radiometer (MWR), and a micro rain radar (MRR-2), with different products of the Weather Research and Forecasting (WRF) model. The abovementioned instrumentation, was located in the Port of Navacerrada (Madrid) during the years 2011-2013, and at the Aerodrome of Rozas (Lugo) from 2016 to current. The WRF simulations were generated on 4 nested domains, centred on the study locations. These 4 domains have a horizontal resolution of 27 km, 9 km, 3 km, and 1 km, respectively. The results obtained from the instrumentation and the WRF mesoscale model correspond to several selected days within the SafeFlight project. The variables examined in this research are: temperature, and LWC estimated by the MWR and the WRF model at distinct heights. The MRR-2 also provided data of LWC at different heights.
The values of temperature and LWC obtained by the MWR and the WRF model are very similar. However, the LWC data measured by the MRR-2 show some differences with the data collected by the MWR and those estimated by the WRF model.