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ALC profiling: valuable information to support the radiation fog forecasting in the airports

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Radiation fog is the most frequent cause of surface visibility below 1 km, and is one of the most common and persistent weather hazards encountered in aviation and to nearly all forms of surface transport. Forecasting radiation fog can be difficult, a number of approaches have been used to integrate the satellite data, numerical modeling and standard surface observations. These approaches lack generally the vertical and temporal resolution, representation of boundary layer and microphysical processes. They typically do not represent accurately the activation processes of fog droplets that depend on the chemical and physical properties of the aerosols.

The attenuated backscatter profile measured by automatic LIDAR-ceilometer (ALC), primarily used to detect the cloud base height, may be influenced by atmospheric humidity especially during the preliminary stage of radiation fog formation. The hydroscopic aerosols in the boundary layer see their size increase with their moisture content inducing an increase of the attenuated backscatter.

The monitoring of the hydroscopic growth process through the attenuated backscatter signal measured by ALC, found at most airports, could provide useful warning to forecasters, in support of their fog forecast, minutes to hours prior to formation of radiation fog. In this context, a forward stepwise screening algorithm (PARAFOG) was developed (Haeffelin et al., 2016) and intends for use as a new decision support system for radiation fog forecasting based on analysis of the attenuated backscatter. This development was initiated in the framework of TOPROF (COST-ACTION, http://www.toprof.imaa.cnr.it/) activities between the Royal Meteorological Institute of Belgium (RMI) and the Site Instrumental de Recherche par Télédéction Atmosphérique (SIRTA, IPSL).

In this presentation, we will describe the methodology used in PARAFOG to derive pre-fog formation alerts and we will show a selection of several radiation fog events observed on several different airport sites to illustrate the efficiency of PARAFOG to detect radiation fog events. We will show also the last development on PARAFOG about the reduction of the alert fog duration dependence on relative humidity by adapting the alert threshold values.

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