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Ice fog and light snow measurements using a high resolution camera system

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In this presentation, measurements collected by the ice crystal imaging (ICI) probe employed during FRAM (Fog Remote Sensing and Modeling) project for the Winter of 2010-2011 in Yellowknife, NWT, Canada are analysed to study small ice crystal impact on aviation operations. Ice fog, diamond dust, and light snow form during cold weather conditions and they affect aviation operations through visibility and deposition over the surfaces. In addition, these events influence the local heat budget through radiative cooling. Prediction of these hydrometeors using models is difficult because of limited knowledge of the microphysical properties at the small size ranges. These phenomena need to be better represented in forecast and climate models and this can only be done using accurate measurements from ground-based instrumentation. Imaging of ice particles' properties can complement other in-situ measurements being collected routinely.

The newly developed ICI probe, aimed at measuring ice fog and light snow particles, is presented here. The ICI probe samples ice particles through a vertical inlet, where a laser beam and photodetector detect ice crystals contained in the flow. The detected particles are then imaged with high optical resolution between 10 to 1000 micron size range. An illuminating LED flash and image capturing for measurements are triggered by the photodetector.

The results suggested that the majority of ice particles during the two-month long campaign were small with sizes between 300 μm and 800 μm. During ice fog events, the size distribution measured had a lower mode diameter of 300 μm compared to the overall campaign average with mode at 500 μm. In this presentation, challenges and issues related to small ice crystals are described and their importance for aviation operations and climate change are discussed.