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Interferometric imaging for the characterization of ice particles and droplets in the atmosphere


The characterization of water droplets or ice particles in the atmosphere is important for aircraft safety and meteorology. Interferometric out-of-focus imaging offers an interesting solution: The technique allows indeed size measurements of both kinds of particles, leading to a possible estimation of Ice Water Content and Liquid Water Content. In this technique, liquid droplets generate two-wave interference patterns whose frequency gives the droplet's diameter. Ice crystal characterization is based on the analysis of speckle patterns. Prototypes based on interferometric particle imaging have thus been developed and tested in flight. In this lecture, the instrumentation developed to perform accurate size measurements will be described. The presentation will address:

(i) the principle of the analysis of speckle patterns for ice crystal sizing, (ii) the development of laboratory instrumentation around a freezing chamber, (iv) their combination to ice crystal growth simulation using phase field modelling, (v) the generation of programmable pseudo-particles using a Digital Micromirrors Device and (vi) design considerations for the realization of an airborne instrument.

Speaker Biography

Marc BRUNEL has completed his PhD in 1996 from Paris-Sud University, France. He is a Professor in Rouen Normandy University. He has published over 120 articles in International periodic journals. His domains of research in laboratory CORIA are interferometric imaging of particles, digital holography, laser / particle interaction, and laser metrology.

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