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Corona-imaging colorimetric method for accurate measurement of the size of water droplets in an expansion chamber

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Accurate and time-resolved measurement of the size of water droplets is a pre-requisite for the study of microphysical processes of cloud formation using an expansion chamber. We developed a new method using color images of corona observed under illumination of a white-light beam, also known as the corona-imaging colorimetry (CIC) method. In the CIC method, RGB data from images obtained by a commercial digital camera are converted into standard colorimetric parameters. The droplet size is estimated by optimizing the agreement of the measured colorimetric parameters with those estimated using Mie theory. For polystyrene latex spheres suspended in water, the particles size estimated by the CIC method agrees to within 2% of the predetermined value. We apply this method to the time-resolved measurement of the size of water droplets formed in an expansion chamber. The CIC method is technically simple and enables accurate and instantaneous measurements of the size of droplets with diameters larger than about 10 um. In addition, the CIC method is advantageous over the Constant Angle Mie Scattering (CAMS) method, which requires a specially designed optical system with a laser light source and complete information of the growth history of the droplets.

In our presentation, the details of the theoretical aspects and colorimetric treatments of the CIC method will be discussed.

Keywords: Corona, Cloud Droplets, Sizing, Chamber, Condensation