



Laboratory measurements of cloud droplets size/velocity distributions with shadowgraph imaging technique

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In the present study, we investigate capability of the Oxford Lasers VisiSize D30 system in measuring cloud droplets size/velocity distributions by performing series of laboratory tests. Size/velocity distributions of a cloud of small water droplets of $\sim 10 \mu\text{m}$ diameter, produced by means of an ultrasonic fog generator, and advected with forced flow are measured using a technique called “Particle/Droplet Image Analysis” (PDIA). Aforementioned method involves illuminating the region of interest from behind by using incoherent, expanded and collimated laser light beam and collecting shadow images of droplets at up to 30 frames or pairs of frames per second with a digital camera. The laser and camera are triggered so that a single laser pulse freezes the motion of droplets present within the measurement volume during each frame capture. Droplets detected inside the depth of field are then measured based on their shadow images. Velocity is estimated from the position shift in a pair of images. Finally, a size/velocity distribution is built by analysing a series of images.

The tests described here demonstrate the technique and establish the potential for further quantitative studies of size/velocity distributions of cloud and fog droplets as well as precipitation particles.