



Measurements of cloud droplet size distributions with shadowgraph imaging technique

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Capability of the “Oxford Lasers VisiSize D30” instrument, which works based on the shadowgraph imaging technique, in measuring cloud droplets size distributions has been investigated. To this aim, series of field measurements have been performed in July 2018 at the Umweltforschungsstation Schneefernerhaus (UFS) camp on Zugspitze in German Alps [1].

Droplet sizing method applied by the system is called “Particle/Droplet Image Analysis” (PDIA) which 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” 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, and size distribution is built by analyzing a series of images.

Obtained droplet size distributions are compared to similar distributions obtained from another instrument, using Phase Doppler Interferometry (PDI) to measure droplet sizes, “PDI Flight Probe, Dual Range” (FPDR) from Artium Tech. Inc., which was working simultaneously at the measurement site.

Initial results indicate, that droplet size distributions from both instruments agree well in a certain range of droplet sizes close to the middle of ranges specified by the manufacturers. However, when approaching the ends of the manufacturer provided ranges (in particular for small droplets) discrepancies in distributions obtained from both instruments became substantial.

[1] Siebert, H., Shaw, R. A., Ditas, J., Schmeissner, T., Malinowski, S.P., Bodenschatz, E. and Xu, H., 2015: High-resolution measurement of cloud microphysics and turbulence at a mountaintop station, *Atmospheric Measurement Techniques*, vol. 8 , pp. 3219-3228 , 10.5194/amt-8-3219-2015