Geophysical Research Abstracts
Vol. 17, EGU2015-12232, 2015
EGU General Assembly 2015

Beyond rain: Advances in measurements of solid or mixed phase precipitation using a 2D-Video-Distrometer

Martin Schwinzerl, Michael Schönhuber, and Günter Lammer
JOANNEUM RESEARCH Forschungsges mbH, DIGITAL, Graz, Austria (martin.schwinzerl@joanneum.at)

The requirement to estimate for each individual hydrometeor precipitation parameters such as shape, equi-voluminous diameter, fall velocity, height to width ratio, and canting angle gave rise to the development of the family of 2D-Video-Distrometer (2DVD) measurement devices. The measurement principle of the 2DVD is based upon the ability to acquire a side- and front view onto each particle by virtue of two orthogonally arranged high-speed line-scan cameras. The cameras are displaced vertically towards each other by a precisely determined distance in the ballpark of 6 mm, thus allowing the estimation of the vertical fall velocity in-situ on a per-particle basis. The geometrical and velocity information, sampled over a measurement surface of approx. 100 x 100 mm in this way, is then used to derive observables like rain rate and the accumulated equivalent amount of precipitation with a high degree of statistical relevance. One of the biggest assets of this measurement principle is the ability to perform measurements without relying on any externally provided model or phenomenological relationship between observables like particle shape and velocity. For liquid precipitation in the form of natural rain, this allows for example to verify whether established relationships - like, for example, the tabulated values for diameter vs. vertical velocity provided by Gunn & Kinzer - can be reproduced in sampled datasets.

For mixed-phase and solid precipitation, different types of hydrometeors like for example different snow flake families, hail and graupel yield – depending on parameters like for example the water content and therefor, in turn, the density of the particle – very diverse results with respect to expected fall velocity, oblateness, or general shape for a given diameter class. The ability of the 2DVD to capture these parameters directly and without reliance on externally provided relationships, has contributed to the attractiveness of this measurement device for in-situ measurements of such mixed or solid precipitation. One of the biggest challenges identified in this specific field of application of the 2DVD is to reliably match the individual shapes gathered by the two cameras, especially in the presence of many potential matching partners during heavy and dense precipitation. By continuously refining of the established matching procedures originating from the rain measurements and adapting the parameters entering this matching algorithm, this challenge has been addressed with respect to the 2DVD. We will provide a summary of some of the recent developments and specific improvements in this area and will also outline the potential of applying the results found towards this end on the related development of a 1D-Video-Distrometer (1DVD), which in contrast to the 2DVD would have to rely on externally provided information in order to obtain a similar quality of results.