Geophysical Research Abstracts
Vol. 16, EGU2014-3909, 2014
EGU General Assembly 2014

Detailed Precipitation Measurements for GV: Advances in Video-Distrometers

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The 2D-Video-Distrometer (2DVD) is an established instrument for in-situ measurements of precipitation, delivering per-particle data for solid, liquid and mixed-phase precipitation and having over 80 successful deployments world-wide to its record. At its core, two orthogonally oriented, vertically displaced and precisely aligned high-speed cameras sample hydrometeors like rain, snow, hail, graupel, ice-pellets, etc. as they fall through a sampling area of approx. 100 cm^2. This measurement principle, i.e. having two projections for each detected particle while gathering statistically significant data by sampling over a substantial measurement area, allows capturing and evaluation of observables like diameter, oblateness and shape, vertical velocity, and contributions to the rain rate and to the cumulative amount of rain for each individual detected particle. If particles display rotational symmetry, estimation of horizontal velocity and (for particles exceeding a diameters of approx. 1.5 mm) canting angles can be gauged, again on a per-hydrometeor basis, as well.

While the 2DVD has been successfully deployed during many ground validation campaigns, some of the inherent cost and complexity constraints have so far prevented the use of 2DVD's for some applications and in some environments. In order to address these limitations of the 2DVD, research has been conducted to develop a 1D-Video-Distrometer (1DVD) which employs only one camera system but tries to retain the capability to capture as many observables on a per-particle basis as possible. First results from our activities towards such a system with reduced complexity and deployment costs are presented and comparison of data sets gathered with both 1DVD and current generation 2DVD systems are provided.

Current generations of the 2DVD can yield exceptionally high data rates, especially during extreme rain events like for example tropical storms. Therefore, the software suite which accompanies each device employs dedicated algorithms and procedures in order to meet the arising high demands with respect to throughput, scalability and stability, thus allowing the instrument to cope very well with such very high data rates. Advances in camera technology, which allow for higher resolutions and larger scan rates, are bound to contribute to further increases in the amount of data. Moreover, the degree of integration and the level of complexity in forming precipitation products, including measurements from GV, are also on the rise. Due to these influences, improvements to algorithms and data formats have been studied and first results of these improvements for the 2DVD and upcoming 1DVD are presented as well.