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Microphysical properties of snowfall in the Swiss Alps as measured with a Multi-Angle Snowflake Camera

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In solid precipitation, snowfall rate can be estimated from weather radar using relationships between solid hydrometeors microstructure (size, shape, mass) and their scattering properties. These relationships are difficult to estimate and remain largely uncertain, mainly due to the rich variety of shapes, sizes and properties that snowflakes and ice crystals can adopt in the atmosphere. It is therefore essential to document the microstructural properties of individual falling snowflakes in order to better characterize the microphysics of snowfall as well as to improve its quantitative estimation.

In this study, we utilized a new supervised classification method applied on pictures recorded with a Multi-Angle Snowflake Camera (MASC) in order to classify observed particles into 6 distinct hydrometeor classes (columnar crystals, planar crystals, combination of columnar and planar crystals, aggregates, graupels and small particles) and estimate their degree of riming on a continuous scale ranging from zero (no riming) to one (graupel). The classification is performed on more than 8 months of MASC data collected in the Swiss Alps. The outcome is in turn used to investigate important microstructural properties of falling snowflakes (particle size, aspect ratio, orientation, fallspeed) and refine the relationships between them (e.g. shape-size, fallspeed-size) as a function of the hydrometeor type and degree of riming.

In addition, collocated measurements from a two-dimensional video disdrometer (2DVD) are used to evaluate the accuracy and the uncertainties associated with the MASC fallspeed retrieval system. The two instruments were both located in a Double-Fence Intercomparison Reference (DFIR) during the measurement campaign in a configuration aimed to minimize the influence of wind and ambient turbulence on snowflakes fall velocity.