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Snowflake classification using pictures collected with a Multi-Angle Snowflake Camera

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Hydrometeor classification methods aim to categorize precipitation in qualitative classes describing the dominant type of falling particles in a given volume. In the present work, a method has been developed to automatically classify snowflake pictures recorded with a Multi-Angle Snowflake Camera (MASC). The MASC is a ground snowflake imager which captures high-resolution photographs of hydrometeors from three different angles while measuring their fall velocity.

For each snowflake image, a large set of geometrical (e.g. particle maximum dimension, aspect ratio, shape complexity, fractal dimension, skeleton) and textural descriptors (e.g. mean brightness, local interpixel variability, co-occurrence matrix) is computed and used as an input for the classification. Seven classes of hydrometeors (Aggregates, Dendrites, Plates, Columns, Graupels, Melting snow and Small Particles) have been manually identified. To automate the process, pictures of individual snowflakes are classified by means of a Support Vector Machine (SVM), adapted to provide a membership likelihood index associated with each prediction. The method achieved high classification performances, with an average overall accuracy above 90% and a balanced error rate below 10%. The algorithm is sufficiently fast to classify MASC images in real-time and can be deployed directly on the data acquisition computer.

In order to evaluate the proposed technique, a comparison with an existing classification method applied on measurements collected in the Swiss Alps with a collocated 2 Dimensional Video Disdrometer will also be presented.