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Ice particle classification using a deep learning algorithm

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For a better understanding of cloud processes, accurate observations of ice crystal number concentrations and size spectra are important. We measure the cloud microphysics with the holographic imager HOLIMO. Holography is the only measurement technique, which allows the recording of the concentration, the size, the shape, as well as the spatial distribution of cloud particles. The classification into water droplets and ice particles is based on the particle shape (spherical or non-spherical) and is done using supervised machine learning. Since ice particles are quite variable in size and shape and rare compared to water droplets, a conventional classification tool, like a tree, is incapable of identifying ice particles sufficiently well. In order to improve the automated classification of cloud particles, we are developing a deep learning algorithm. The algorithm hopefully recognizes important features, which are overlooked by a human user. Above that, it can work with nonlinear functions and is thus able to find complex correlations between input parameters and the cloud particle classes, for example, if the interference pattern may state something about the particle phase or shape.

Significance statement

Imaged-based probes have the advantage that no assumptions are necessary on the shape of recorded particles. Yet the classification remains time-consuming and error-prone, due to the variable shape of ice crystals. Recent progress in deep learning techniques provides confidence in improving the automated classification of ice particles.

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