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Classification of particle shapes from lidar depolarization ratio in convective ice clouds compared to in situ observations during CRYSTAL-FACE

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Abstract

A technique to classify ice particles into different shape categories, based on lidar depolarization ratio, is considered. This technique is applied to observations taken during the Cirrus Regional Study of Tropical Anvils and Cirrus Layers–Florida Area Cirrus Experiment (CRYSTAL-FACE) campaign with the airborne Cloud Physics Lidar. The retrieved relative concentrations of particle shapes are compared with shape images from an airborne, in situ, cloud particle imager probe, operating in the same cloud. A first high-resolution time-based comparison, conducted over a short period of close collocation, leads to a good agreement between both techniques, with an average difference below 5% in retrieved relative concentrations. The same technique applied over the entire lifetime of three different convective ice clouds cases shows a maximum difference below 10% in average retrieved relative concentrations. The application of this technique to future spaceborne observations could lead to large-scale classification of particle shapes in ice clouds.