Automatic detection and characterization of the melting-layer on X-band polarimetric radar scans

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Stratiform rain situations are often associated with the presence of a melting layer characterized by a strong signature in polarimetric radar variables. This layer is an important feature as it indicates the transition from solid to liquid precipitation. Despite this, the melting-layer has seldom been thoroughly characterized particularly from a polarimetric radar point of view.

In this work we propose a new algorithm to automatically detect the melting-layer on X-band polarimetric RHI radar scans using gradients of reflectivity and copolar correlation. Both variables are first projected from polar to cartesian coordinates, then normalized and combined. The resulting image is scanned columnwise by searching for strong gradients which should correspond to the boundaries of the melting-layer. The algorithm proceeds in two steps with a geometrical integrity check on the second one to reduce the impact of artifacts and ground clutter and ensure a consistent melting-layer

By using this algorithm on a large selection of precipitation events (more than 4000 RHI scans) from different seasons and climatic regions (Alps, Mediterranean, Great Plains), we were able to compute a large amount of relevant statistics. These statistics include information about the geometry such as the thickness or the variability at the boundaries as well as the polarimetric signature such as the amplitude of the bright-band and the distributions of polarimetric variables. Besides providing information about an important but relatively poorly known characteristic of stratiform rain, this work could give relevant data for comparison with numerical weather model outputs or measurements of the 0°C isotherm height.