Assessment of severe hailstorms and hail risk using weather radar data

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Severe hailstorms occurring during the convective season carry a high risk, being responsible for damages in agriculture, to automobiles and buildings. During the last years, damaging hailstorms have been reported as causing major losses. Due to high risk potential associated with severe hailstorms, comprehensive information about their intensity and duration is essential for loss prevention and risk management. Because of the high temporal and spatial variability of the convective storms, these are not always captured accurately and uniquely through ground observations. The use of weather radars to identify damaging hailstorms was found to be a very feasible option.

This study aims at developing radar products and investigating their relationship to severe hailstorms and damages at the ground. Furthermore, the usefulness of these products in updating the hail climatology and in identifying regions exposed to hail risk is addressed. Thus, composite radar reflectivity was used to identify hailstorms and to evaluate their strength, longevity, and swaths. High resolution echo top heights, vertically integrated liquid, and vertically integrated liquid density products were developed and used to assess the storm severity and the likelihood to produce hail. Radar-derived hail kinetic energy flux has been used to identify hail and damages at the ground.

Various severe hail events that caused damages were investigated, results showing good agreement between radar data and severe hail reports and damage surveys. Statistic parameters computed over long periods makes the approach useful in identifying regions exposed to hail risk. Our general conclusion is that radar-derived parameters proven to be valuable in assessing damaging hailstorms, but they cannot solely fulfill this purpose. Combination of radar measurements, surface observations, damage surveys, and insurance data would improve the results, with the advantage of the high spatial and temporal resolutions of radar measurements.