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Hail detection with a C-band dual-polarization weather radars in Finland.

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Radar hail signatures at C-band are ambiguous. Due to a high spatial and temporal variability of hailstorms, it is very difficult to provide sufficient ground-truth observations to validate these measurements. Furthermore, for the same reason, performance of current hydrometeor classification algorithms is very rarely quantified in terms of such metrics as for example probability of hail detection.
Dual-polarization weather radars are effective tool for hail detection. The FMI (Finnish Meteorological Institute) radar network consists of ten C-band Doppler radars. Nine of them are dual-polarization radars. This gives new possibilities for development methodology of the operational detection of hail and radar products of hail events. Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, buildings roofs, houses, and vegetation are the other targets most commonly damaged by hail. The largest hail detected in Finland have a diameter of 8 cm.
This research is a part of my doctoral dissertation. My doctoral dissertation focuses on the “Application of dual-polarization weather radars for operational precipitation monitoring”.
I hope to develop new ways to extract relevant information to aid understanding of in-cloud processes and particularly hail formation and cycling, towards establishing new operational capabilities from dual-polarization radars and for the operational assessment of dual-polarization radar products especially in connection with hail events.
This research ultimately aims to develop a new methodology for hail detection and the application of these new results for dual-polarization radar products in the operational forecast and warning system process. These products will greatly contribute to an enhanced capability for the identification of severe weather threats, precipitation types, and precipitation accumulation. These products are rather complex and thus their proper interpretation will require deeper investigations and some broader experience. Currently, there is no methodology for the operational detection of hail.
In this study, I utilize a unique dataset collected at Helsinki Testbed to address the above-mentioned problems. Finnish Meteorological Institute and Vaisala established the Helsinki Testbed in 2005 jointly. As a part of the Testbed instrumental setup, more than 60 Vaisala WXT 510 weather transmitters were installed in the Helsinki Metropolitan area. The weather transmitters are capable of precipitation intensity measurements, as well as of discrimination between rain and hail. Since the establishment of the Testbed, the transmitters have reported more than 100 hail hits. This is a unique dataset since it is not only providing records of hail occurrences, but also provides exact location and times of those events. Our preliminary comparison of radar observations and the WXT hail reports, show a good agreement between those observations. Also were compared of radar observations and the Probability-Of-Hail (POH). Those observations were typically taken during late spring several cases are from October and December.