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ZDR-Column Detection in Switzerland

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Information on the presence of differential Reflectivity Columns (so called ZDR-Columns) is known to improve nowcasting of hail and thunderstorm intensification, particularly in the US. In Europe however, little is known about ZDR-columns and their effect on nowcasting skill so far and ZDR-columns have not yet been thoroughly investigated.

Here a real-time ZDR-Column-Detection-Algorithm implemented by the Swiss Federal Office of Meteorology and Climatology (MeteoSwiss) is applied to radar data from the Swiss national weather radar network. First, the algorithm is verified with manually detected ZDR-columns. Then, the algorithm is optimized towards the Swiss Radar Network (considering calibration and sampling strategy) and ZDR-column characteristics in Switzerland. In a last step a statistical analysis over 2-3 thunderstorm seasons (2016, 2017 and 2018) is conducted to gain insight into the properties of ZDR-columns and the corresponding convective cells, and most importantly, to derive information about potential gains in lead time for thunderstorm intensification detection and hail nowcasting applications.

Preliminary results show that ZDR-Columns can be detected in Switzerland and that particularly higher columns are related to evolving thunderstorms and hail cells detected by the MeteoSwiss Thunderstorm-Radar-Tracking-Algorithm (TRT). Further we observed that in some case studies, ZDR-columns occurred 5-10min prior to the automated thunderstorm cell detection through the Thunderstorm-Radar-Tracking-Algorithm (TRT). This indicates the potential for a lead time extension in thunderstorm and hail nowcasting. Through 5 case studies, we have identified a couple of potential improvements for the algorithm: The correct estimation of the ZDR-column height could be enhanced by accounting for the tilting/space-time-transition due to the sampling strategy and by tuning the differential reflectivity threshold.

Another challenge is to separate thunderstorm-related ZDR-Columns from false detections through three-body scattering. This issue is handled by introducing a maximum reflectivity (MAXECHO) mask.