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EchoTop height estimations across the Swiss Radar Domain – possibilities and limitations

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Radar EchoTop heights (ETs) indicate the maximum height at which a certain radar reflectivity value is identified within a vertical column of reflectivity measurements. ETs are frequently used as proxies for storm core height (e.g. 45 or 50 dBZ) or storm top height (e.g. 15 dBZ). Generally speaking, the higher the ET, the higher is the vertical extent of a storm and the greater is its severity. Different ET levels are commonly required in the computation of severe weather algorithms, such as e.g. operationally used Probability of Hail (POH), Maximum Expected Severe Hail Size (MESHS), Thunderstorms Radar Tracking (TRT) and Vertical Integrated Liquid (VIL).

The five Swiss dual-polarisation C-Band Doppler radars operate in complex terrain and are located at altitudes between 938 m and 2937 m. A special scan strategy was developed for the 4th generation Swiss radars (operational since 2011), involving two interleaved half-scans and reaching a high elevation angle of 40°. Considering Albis radar, the lowest radar site within the network, 13 out of the 20 total scans performed every 5 minutes reach a vertical height of around 18 km. These beams reach a distance of 162 km from the radars, going beyond the Swiss territory. This is the main region of interest and confidence. Currently no vertical interpolation and/or extrapolation of reflectivity values is performed before ET computation. Beyond the 162 km range, up to the maximum distance of 246 km, the maximum elevations that the beams reach are lower than 18 km and do not always observe the more elevated parts of storms. This means that at great distance from the radar the retrieval of high-dBZ ETs, such as those used for the hail algorithms POH and MESHS, is limited, not only by beam broadening, but also by the scan strategy.

On this poster we present possibilities and limitations of ET computation within the Swiss Radar domain. We show comparisons of the current ET algorithm and alternative methods and further show how we may improve the homogeneity of the ET product over the entire Swiss radar domain, slightly reducing the impact of scan-strategy-induced artefacts beyond 162 km.