



Signatures of Convective Wind Gusts from the Operational Radar Network in Switzerland

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From April to September severe storms regularly affect the Alpine and pre-Alpine region. Heavy precipitation, wind gusts and large hail can cause substantial damage and represent extremely high costs for insurance companies.

Accurate real-time point measurements of wind gusts within Switzerland are available from about 130 ground weather stations. Due to the high spatial and temporal variability of wind gusts they however present major limitations in terms of representativeness for the remaining areas. With weather radar data the 3D development of gust-producing thunderstorms can be observed in real time with high spatial and temporal resolution.

Algorithms for wind gust detection from radar data, often explicitly employing Doppler wind fields, have been developed for flat topographic areas. These procedures cannot directly be adopted in complex terrain such as Switzerland and for the configuration of the operational fourth generation C-Band Swiss Radar Network. On the one hand, the radar beam visibility close to the ground, where wind gusts occur, is often limited by orography and the radars are not close enough to form a dual- or multiple-Doppler network. On the other hand, the choice for long-range measurements entail relatively low Nyquist velocities, with the consequent need for highly sophisticated dealiasing procedures to obtain velocities that are typical for strong wind gusts. Furthermore, these methods are frequently developed for the detection and nowcasting of mesocyclones, which are only a small contributor to strong wind gusts in Switzerland. Hence novel approaches need to be considered.

Analyses of radar-derived fields typically related to severe storms (e.g. Echotop45, VIL, probability of hail) in the area of influence of weather stations before and during observed high wind gust occurrences are carried out to identify radar-based proxies. Proxies are searched for both as a posteriori detection to construct comprehensive wind gust maps and as pre-cursor signals of wind gusts to contribute to severe weather warnings. Results of these analyses are presented at the conference.