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Fully automated thunderstorm warnings and operational nowcasting at MeteoSwiss

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Short-term severe thunderstorm warnings are one of the main tasks for a national weather service. Convective storms can cause substantial damage and can represent a serious danger to population and infrastructure. In case of severe thunderstorms MeteoSwiss alerts authorities and the population by means of flash-news warnings with a lead-time of some tens of minutes. These short-term warnings are based mainly on the operational, multi-sensor nowcasting system TRT. TRT includes a classical cell tracking and position extrapolation module, based on the measurements of the Swiss Dual-polarization Doppler radar network. Every 5 minutes this module computes individual motion vectors for each identified cell and estimates the uncertainty of the cell position forecast. It also runs a heuristic cell severity ranking algorithm that integrates the most significant severity attributes from the 3D storm structure in a single numerical parameter in order to assess the potential danger posed by the individual cells.

Although the current nowcasting systems run automatically, the final decision for the warning and its release are taken by the forecaster on duty. To speed up the whole warning process and to allow the final users (such as emergency services, authorities, and the general public) to save several minutes to take action, the prototype of a fully automated, short-term, small-scale real-time warning system was developed and tested during the summer season 2014-2015. The full warning chain was completely automatized, including decision making and warning issuing by SMS. The tool allows a user to receive thunderstorm information for a given specific location directly and automatically on his phone whenever the system detects an approaching cell.

The new algorithm integrates the cell severity ranking product and the latest cell motion vectors from the TRT system to extrapolate cell position; it also accounts for the forecast uncertainty. Alerts are characterized by four intensity levels. They are computed every 5 minutes for the next 30 minutes and are issued for every ZIP code (mean size of about 10 km2 in populated areas). In the current manually driven system, in contrast, the warning areas have a mean size of about 250 km2.

The new fully automated thunderstorm warning system will be presented in this paper and first results from the test campaign will be discussed. An outlook is also given on the potential of future developments integrating multi-sensor information from related research projects on precursors of thunderstorm formation from MSG satellite and signatures of convective wind gusts.