An operational nowcasting system for severe quasi-stationary and fast moving thunderstorms in the Alps

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(Dated: 02 March 2010)

Abstract

In the Alps with its complex orography even relatively small but intense thunderstorms can produce local flash-floods causing severe consequences and damages. Quasi-stationary cells can be very insidious, because particularly small catchments are sensitive to the exact location of precipitation. On the other hand, orography may also lead to the organization of fast moving cells at the meso-beta scale in the pre-Alpine and plateau region. To address these problems we attempt a new way by combining the object-based nowcasting system TRT (Thunderstorms Radar Tracking) with radar QPE.

MeteoSwiss alerts authorities and population in case of severe thunderstorm, by means of real-time flash-news warnings with a lead-time of 30-60 min. For these short lead times the real-time, multi-sensor nowcasting system TRT is used operationally with a resolution of 5 min, in addition to usual short-range forecasting tools. To account for the potential of quasi-stationary thunderstorm cells to cause flash-floods, TRT was enhanced by a module for the ingest of QPE precipitation maps from the radar network. Different percentiles of precipitation accumulation inside each cell are computed for the last 1-3 h, in fixed coordinates. This computation is extended also to the footprint of the 1 h forecast of cells positions. If the accumulation for a particular cell exceeds a defined threshold, the forecaster is automatically alerted in real-time. Based on the current and forecasted position he evaluates the potential of the cell to cause a flash-flood and sends a flash-warning message if necessary.

To account for severe fast moving thunderstorms, the heuristic cell severity ranking algorithm was substantially improved. This algorithm concentrates the most significant cell severity attributes from the 3D storm structure (e.g. VIL, 45 dBZ Echo Top, max reflectivity,…) in a single numerical parameter. To compute the rank the categories with fixed thresholds are modified to continuous values without changing the maximum possible score. The area of the intense cell cores is added to the weighting scheme of the rank computation. This allows it to give higher weight to severe and large thunderstorms like supercells and squall-lines.

The presentation will focus on the latest operational improvements of the TRT system for the quasi-stationary and fast moving cells, and show first preliminary results from the FP7 research project IMPRINTS that can be included into TRT. IMPRINTS will develop an improved extrapolation technique that combines Lagrangian persistence of radar precipitation fields with orographic forcing in complex orography. This QPF information can be used to extend the lead-time of the nowcasting warnings, including the precipitation accumulation for the forecasted position of quasi-stationary cells.