18–22 September 2017, Pula, Croatia
ECSS2017-119

Object-based operational nowcasting of severe thunderstorms in the Alpine area

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Since the beginning of 2017 MeteoSwiss alerts authorities and the population in case of severe thunderstorms by means of fully automated, short-term warnings sent to an App. These warnings are based mainly on the detection and tracking of individual storm cells by the real-time, multi-sensor Thunderstorms Radar Tracking (TRT) nowcasting system. TRT is an operational, object-based system that follows the time evolution of each cell with high spatio-temporal resolution (1 km2, 5 min) and is able to detect even small thunderstorms of only few km2. The temporal development of the most significant radar-based severity attributes of the cells (e.g. VIL, VIL-density, EchoTops, max reflectivity, QPE, hail size and probability,...), as well as lightning (CG, IC) and geometric parameters (e.g. centroid, area, velocity,...), is computed from the 3D storm structure and displayed automatically. The severity of each cell is heuristically assessed by a 3D-Rank algorithm and integrated in a single numerical value.

The latest version of TRT additionally integrates the cell-based evolution of cloud top temperatures (CTT) from the IR 10.8μm channel of MSG/SEVIRI rapid scan measurements. This parameter shows the cooling trend of the single convective cell cores and is relevant for intensity estimation especially in the initial stage of the storm life cycle. In the later stages, radar parameters are mainly used to characterize the cell evolution. Another innovation is the computation for each cell of the polarimetric parameters (e.g. ZDR,...), as well as the output from the new MeteoSwiss semi-supervised polarimetric hydrometeor classification algorithm. The integration of this information allows a better real-time characterization of the hail-producing potential of single cells, to enhance the short-term evolution forecast, and to improve the automated warnings.

The paper will focus on the latest operational version of TRT and present the new cell-based, polarimetric and satellite derived attributes. An outlook on future developments using the gridded fields from the related project COALITION-3 applying machine learning techniques to predict the intensity evolution of convective systems is also presented.