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NowPrecip: Localized precipitation nowcasting in the complex terrain of Switzerland

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Abstract

NowPrecip is a new precipitation nowcasting system developed in MeteoSwiss. It is area-tracking and fully-probabilistic, capable of producing multi-member ensembles of possible evolutions. It follows the philosophy of seamless forecasting: evolution begins from the last radar observation and merges smoothly into the numerical weather prediction ensemble members. The application is currently in the state of testing and verification.

The algorithm is based on five new ideas. (a) A geostatistics-based optical flow algorithm, an approach which is spatiotemporally coherent and minimizes artefacts on zero-precipitation areas. (b) A localized approach of the nowcasting problem, as opposed to the typical one of operating on the entire domain. This has been motivated by the need to deal effectively with situations where different rainfall patterns characterize different parts of the domain (c) A straightforward technique to compute and include systematic growth and decay. (d) The ability to use a machine-learning input as a replacement of the typical Lagrangian persistence one. This relies on the algorithm’s localized design and introduces a full methodology for employing state-of-the-art machine learning algorithms into nowcasting. Implementation of such algorithms could potentially capture growth and decay patterns which are, by-design, ignored in Lagrangian persistence schemes. (e) A capability to incorporate and micro-control individual precipitation cells into the evolution. This technique can generate and control the evolution of individual cells, in terms of size, intensity and shape, directly and seamlessly into the precipitation domain.

We essentially attempt to amplify the links between an area-tracking nowcasting process and (a) the NWP output, and (b) the object-tracking or satellite-based convection initiation procedures, in order to maximize the benefits nowcasting can get from such connections.