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Nowcasting radar precipitation growth & decay in complex orography: a probabilistic machine learning approach

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The simplest and most effective way to nowcast precipitation in the next 2 hours is to extrapolate composite radar images along the estimated motion field (optical flow), commonly referred to as nowcasting by Lagrangian persistence. In recent years, there has been a growing amount of studies exploiting machine learning to extract useful (predictable) information from radar archives for precipitation nowcasting. These new methods have great potential, but suffer from the same limitations of statistical and analogue-based nowcasting approaches, for example the inevitable smoothing arising from error minimization and the finite size of archives.

In this contribution, we review recent advances in precipitation nowcasting using machine learning at MeteoSwiss. The talk will present a selection of studies that include both nowcasting of convective cells and orographic precipitation in mountainous regions. Through the presentation, we will answer to the following questions, among others:

- Which are the sources of predictability of precipitation growth & decay?
- How to go beyond a smooth deterministic machine learning prediction?
- How to perform a fair comparison of machine learning and extrapolation-based nowcasts?
- How to reduce the number of predictors by feature selection?
- How to generate new stochastic cells in radar images?
- How to combine machine learning and stochastic approaches for uncertainty quantification?

Finally, we will define a possible way forward both from a research (generative machine learning) and a collaboration perspective (open-source projects, e.g. pysteps).

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