NowPrecip: Localized precipitation nowcasting in the complex terrain of Switzerland.

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Abstract

NowPrecip is a new precipitation nowcasting system currently pre-operational in MeteoSwiss. It is a fully probabilistic, area-tracking algorithm, capable of producing multi-member ensembles of possible evolutions. It supports the paradigm of seamless forecasting: evolution starts from the most recent radar observation and merges smoothly into the numerical weather prediction ensemble members. Emphasis has been given to the realism of the outcome. Typically, the sequence of images that characterize the nowcasting animation are free of artifacts and indistinguishable of radar images.

The algorithm is based on the following new ideas. (a) A geostatistics-based optical flow algorithm, named "NowTrack," which is able to determine automatically the scales of interest of the motion field and is equipped with an outlier control scheme. Such a scheme is particularly useful in capturing accurately complex motion like fine-scale rotation. Some of the motion field examples can be seen in the figure. (b) A localized architecture motivated by the need to address scenarios where distinct rainfall patterns characterize different parts of the domain. This is mostly relevant for complex terrains like Switzerland, and improves the outcome when the precipitation patterns vary north and south of the Alps. This design facilitates considerably the use a machine-learning input as a replacement of the typical Lagrangian persistence, opening the road for employing such algorithms into nowcasting. (c) Techniques to assess and incorporate localized growth and decay into the computation of nowcasts. This is particularly useful for the Alpine terrain where there is often a systematic growth and decay associated with the orography. The growth and decay factors are based on analysis of the available NWP product, allowing for a more efficient coupling between the nowcasting sequence and the numerical model output.

A verification of NowPrecip took place for a sample of representative cases, both stratiform and convective. Both deterministic and probabilistic measures were used and the main outcomes where that: (a) the optical flow scheme is characterized by small errors, (b) the growth and decay mechanism visually improves the outcome over orography, and (c) the skill is better than that of the numerical model output for four hours in average.

References

Sideris IV, Foresti L, Germann U, Nerini D. 2018. NowPrecip: An algorithm for localized probabilistic precipitation nowcasting in the complex terrain of Switzerland, ERAD.
Sideris IV, Foresti L, Nerini D., Germann U. 2019. NowPrecip: Localized nowcasting in the complex terrain of Switzerland, QJRMS, submitted.

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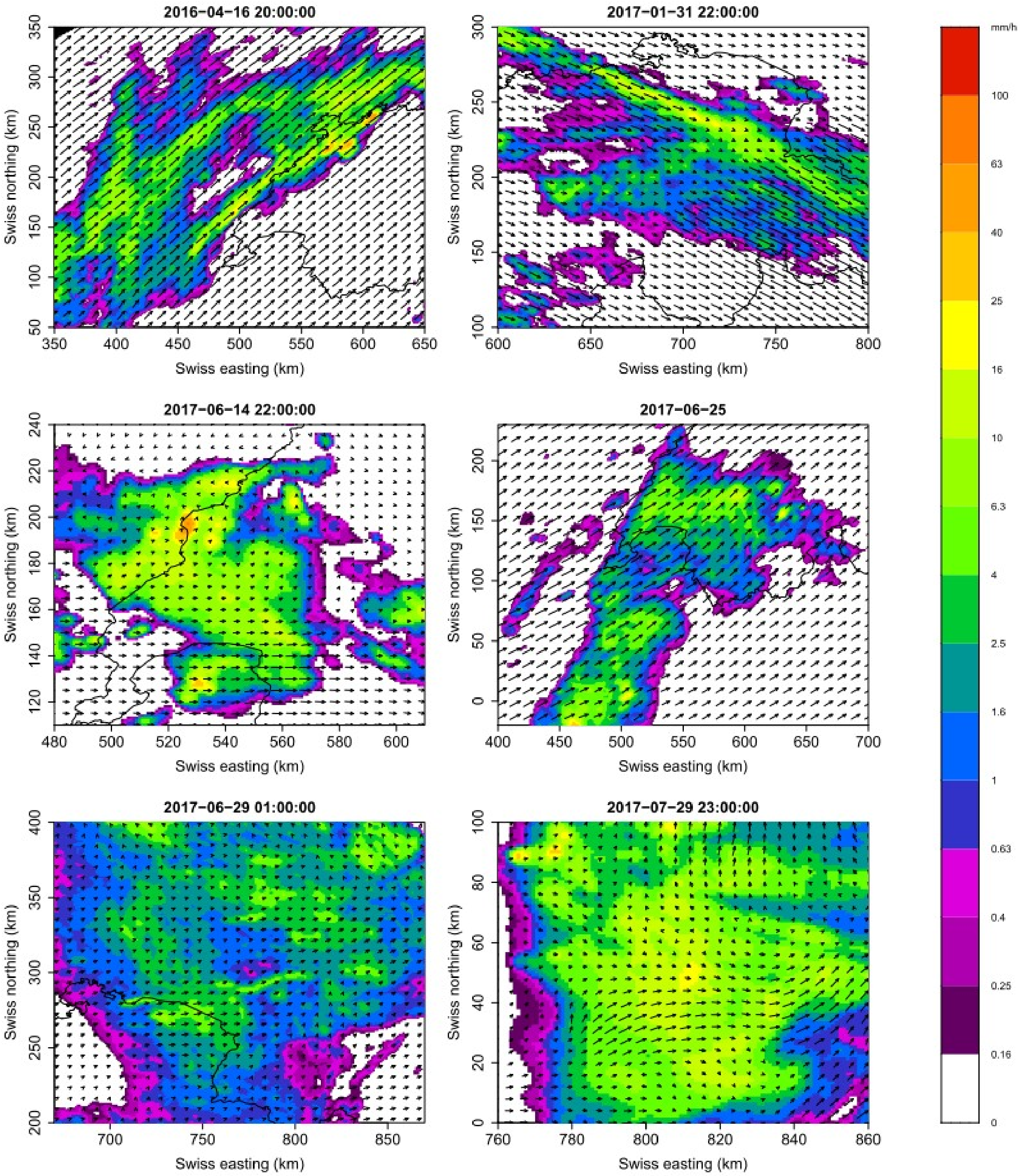
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Swiss easting (km)
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4
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1.6
1
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0.4
0.25
0.16
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