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Optimization of the Analogs method in the framework of statistical weather forecasting in the Swiss Alps

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Probabilistic quantitative precipitation forecasts (PQPF) by means of the Analogs method is being developed for the Swiss Alps. The goal is to provide a statistical forecast to the MINERVE project, which aims at reducing the flood peaks of the Rhône river by means of water retention in dams. Their operation requires precipitation forecasts for several days ahead. This downscaling approach allows bypassing the modeling of physical processes generating the precipitation. Thus, it should extend the information on which decision makers build up their choices, when considered in parallel to physically based numerical prediction model (NWP) outputs processed by MeteoSwiss.

The Analogs method is a simple concept: given a rainfall archive and a meteorological archive containing a large amount of candidate predictors, the goal is to find the best set of predictors and of parameters (time and spatial windows, number of analogs, weightings, etc. . .) which relates synoptic information to local rainfall. This makes the model opened to improvements, with almost endless possibilities that are impossible to explore manually. Thus, an optimizer based on the Nelder–Mead method was implemented to proceed to an automatic parameter calibration. This allows to introduce new concepts and to remove some limitations that existed for the simplification of the manual calibration. Results are in good agreement with known case studies and consistent with the underlying physics..

The different regions in the Swiss Alps are sensitive to distinct meteorological situations. As a consequence, the best predictors vary from a sub-region to another. This was observed for various parts of the alpine Rhône catchment that are characterized by a strong orographic effect under specific circumstances.

The spatial windows of the selected predictor highlight the best location where predictors must be compared to downscale at best the precipitation of a given sub-region. It was found that those locations correspond to features in the patterns of situations giving severe rainfall, which differ from the average state.