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Hourly to 5-minute temporal disaggregation of a merged radar-raingauge precipitation product

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Temporally (and spatially) highly resolved precipitation data is of central importance for the assessment of historical local high impact precipitation events and for nowcasting applications. In Switzerland, quantitative precipitation estimations with a high temporal resolution are provided by radar reflectivity or raingauge measurements with a resolution of 5 and 10 minutes, respectively. The combination of both data sources on a 10-minute resolution is challenging for many reasons, among them are a shift in time between remote and ground observations, horizontal drifts caused by wind and variability in precipitation within a radar pixel. Hence the geostatistical merging of both radar derived precipitation and raingauge measurements is done using hourly aggregated precipitation. A new method to disaggregate the hourly rainfall product called CombiPrecip into 5-minute rainfall maps for Switzerland is presented here.

CombiPrecip is a real-time precipitation data set developed by MeteoSwiss. By means of kriging, it uses hourly radar and raingauge information to produce “raingauge corrected” hourly precipitation of the same spatial resolution as the radar (1 km2). Here, a method is proposed to temporally disaggregate the hourly precipitation into final 5-minute accumulations (CPC5). The 5-minute radar accumulations (AQC5) are known. In theory, for a given hour, CPC5 can be estimated by multiplying each of the 12 AQC5 with the ratio of the hourly CombiPrecip output (CPC60) and the hourly radar accumulations (AQC60). However, there are pixels where CPC60 is positive and AQC60 zero, e.g. when the raingauge sees precipitation where the radar does not, returning a missing value and creating sharp precipitation gradients in the CPC5 images.

Here, a solution to the missing values is presented. First, 12 new AQC5 images are produced, in which the precipitation field is extended by means of a moving average box of size 3. Second, the new AQC5 images are aggregated to produce a new AQC60 image. Third, using the new AQC5 and AQC60, the ratio of CPC60 and AQC60 and its multiplication by each AQC5 can now be computed at every pixel without returning errors. Lastly, the final CPC5 images are scaled so that the sum of the 12 values at each pixel equals to that of the CPC60.