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Precipitation field driven weather radar conversion

Maurizio Savina and Paolo Burlando
ETHZ, Institute of Environmental Engineering, Switzerland (maurizio.savina@ifu.baug.ethz.ch)

Space-time variability of precipitation in orographically complex regions is a challenging research topic. There are only two sources of measurements sampling precipitation with an adequate scale in space and in time: raingauges and weather radars. The former measure precipitation only at the point scale; the latter provide spatial information. Raingauges are often considered reliable, whereas it is known that radar measurements are affected by several uncertainties, among others also those connected with the regional orography. Usually reference raingauges are used to calibrate radar maps.

A local area weather radar (LAWR) has been recently installed on the Kl. Matterhorn (45º.95N, 7º.72E, 3883 m a.s.l.), in south-western Switzerland to investigate the feasibility of circumventing the limitations of conventional large scale radar due to orography. This area is indeed covered by three Swiss C-band weather radars, which, however, are partially blind. The radar installation has been complemented by a network of 36 raingauges. The LAWR is derived by a commercial ship-born X-band radar and it was adapted to detect precipitation by the DHI Group, Denmark. This system allows quantitative estimation of precipitation within 30 km range, while the maximum range for precipitation detection is 60 km.

In order to convert radar reflectivity in precipitation rate it is necessary to perform the so-called radar gauge conversion. In literature there are several attempts to perform point-map radar calibration by relating point (i.e. raingauge) measurements with spatial measurements (i.e. radar maps). It is a straightforward approach, but it can be quite misleading. The spatial variability of precipitation within a single radar pixel can be too high to consider a point value as representative of a whole pixel. We used three months raingauge observations from a dense local network to compute precipitation fields by means of different geostatistical interpolations (e.g. kriging) and then we used them to define the radar gauge conversion.

The raingauge interpolated field based conversion requires longer computational time than the point based calibration and this might be an issue when a real-time conversion adjustment is needed. But, as we expected, the results indicated our approach was less sensitive to systematic radar artefacts and to ground clutter. We show that this can help in identifying off-line storm specific radar calibration that can improve the overall reliability of radar based precipitation estimates.