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Toward increasing the rainstorm hazard understanding by improved weather radar derived rainfall data

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The statistical estimation of extreme precipitation in wide or ungauged areas is an evolving topic, following the improvement in amount and quality of the remote observation products. Rain gauge networks are often not dense enough for properly describing convective localized storms, and interpolation techniques can only reflect the estimation variance determined by the spatial data resolution. In this regard, weather radar time series could provide significant improvement to the spatial characterization of rainfall fields. These potentialities are only partially exploited, as most of the use of the remote sensing products is addressed to nowcasting and warning systems. With regard to the statistical rainstorm hazard assessment, one of the known problems is that data deriving from C-band weather radar are known to underestimate rainfall depths, particularly in the domain of the high intensities.

Aiming at improving the reflectivity-rainfall transformation by means of a space-time adaptive (ATS) procedure, Libertino et al. (2015) found indeed that the application of local radar-rain gauge calibrations to localized convective storms suffers high variability due to the lack of ground information. The considered methodology consists in a quasi-real-time calibration procedure, adopting confined spatial and temporal domains for an adaptive estimation of the relation between radar reflectivity and rainfall rate. This allows one to follow the well-known spatio-temporal variability of the reflectivity-rainfall relation, making the technique suitable for a systematic operational use, regardless of the local conditions. Application of the method in a comprehensive case study shows a reduction of the bias and an increase in the accuracy of the radar-based estimations in space, that is particularly significant for rainfall fields covering wide areas for a relatively long time. Adopting the ATS method in the real-time is then a legitimate ambition for the forecasting of stratiform events. Concerning convective events, the procedure could provide a useful tool for an a-posteriori radar-rain gauges reanalysis of the rainfall fields, able to provide high-resolution databases of rainfall events with the aim of widening the number of available cases for model calibration. The paper discusses advantages and obstacles of a project that would use the above procedure for building a database of radar-observed convective events all over Italy.