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Urban flooding forecasting with weather radar and dense rain gauges network

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The occurrence of extreme rainfall events, especially the ones of short duration, often causes extensive damage and disruption in densely populated areas; this is true because, normally, long-duration light rains are drained in time by urban sewers and do not pose a threat. In flat urban areas, the most frequent hazardous phenomenon linked to brief and intense rainfall is the urban flooding, which is due to the inadequate capacity of urban sewage system to drain high amount of water in a short time. Successful monitoring and forecasting of urban floods requires accurate precipitation estimation because of the rapid flood response as well as the complex hydrologic characteristics of the urban environment. Weather radars are particularly good in this task but, due to uncertainties affecting their rainfall estimations, a common technique to reconstruct the rainfall field is to compare weather radar observations with ground measurements given by rain gauges. In the metropolitan area of Turin, in Italy, both a C-band polarimetric Doppler weather radar and a dense network made by tens of tipping-bucket rain gauges are installed and operational. In order to reduce biases and errors between ground measurements and weather radar rainfall estimations, this study shows the application of a reflectivity / rainfall rate (Z-R) calibration technique applied on the native weather radar grid, taking the advantage of higher resolution obtained near the antenna. As we are interested in intense precipitation, the main objective of this study is to evaluate the performances of the radar with the best statistical adjustment techniques that are able to reproduce properly observed maximum rainfall intensities on hourly basis, using local rain gauges network.