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The Importance of the observation network density in describing spatiotemporal characteristics of events producing urban flooding: a case study in the city of Genoa, Italy.

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The rainfall climatology of the Mediterranean region is characterized by high probability of very intense rainfall events with a duration of a few hours or less and a very limited spatial scale. There is also evidence that this probability is increasing due to climate change.

In urban areas, these extreme rainfall events produce floods and pluvial floods, often in very small areas, depending on the physical-geographical layout of the area. It is therefore of paramount importance, in order to adequately model the ground effects and evaluate flash and pluvial flood risk in small urban catchments, to have an adequate monitoring network for rain events that are highly concentrated in space and time.

This research analyses the event of the 27th and 28th August 2023 that occurred in the city of Genoa, Italy, producing local floods in the historical center and surroundings due to the overflow of the sewer system and very small urban catchments. During the event, a maximum of 400 mm of rainfall in 6 hours was recorded in the eastern sector of the historic centre of Genoa.

We combined rainfall observations and estimates from official or "authoritative" networks (rain gauges and meteorological radar) and rain gauge networks inspired by citizen science principles. The analysis of combined observations reveals a spatial variability of the precipitation field at hourly and sub-hourly timescale that cannot be captured by the current spatial density of the authoritative measurement stations even in an area, like that of the Genoa Region, that shows one of the highest raingauge network density of Italy.

Furthermore, the analysis of short-duration annual maximum time series recorded by the authoritative rain gauge network of the Genoa region shows significant differences even at distances of less than 2 km in the average rainfall depth accumulated over a sub-hourly duration.

In conclusion, the results show that, to have a reliable description of urban flooding-producing rainfall events adequate hydrometeorological monitoring is one of the most important aspects. This may help both in correctly evaluate ground effects of occurred events as well as to improve the methods to draw design hyetographs for flood hazard assessment, especially for urban areas. In this perspective, the integration between authoritative and citizen science networks can provide a very interesting solution.