



Radar based nowcasting to enhance urban resilience to flash floods in the Metropolitan Area of Barcelona

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The North-western Mediterranean coast, including the Catalan littoral zone, faces a high probability of extreme weather events. Climate change exacerbates these challenges by increasing the frequency and intensity of phenomena like droughts, heatwaves, and flooding. The Metropolitan Area of Barcelona, with its dense urban environment and complex topography, struggles with significant hydrological challenges, especially during intense, localized downpours. Efficient drainage is difficult due to the region's coastal location and urban landscape.

To enhance urban resilience, this study emphasizes the importance of using non-structural and structural techniques that mimic natural hydrologic responses, thereby reducing adverse runoff impacts. Understanding the dynamics of convective precipitation at high resolution is crucial for sustainable water management and flood resilience in Barcelona. Improved knowledge of storm structures and rainfall patterns can help predict and mitigate extreme weather effects in the metropolitan area.

This work introduces a radar-based nowcasting approach that utilizes a two-dimensional radar product with three-dimensional atmospheric information to improve early warnings for the urban region with high spatial resolution. Unlike previous methods that relied single levels of radar reflectivity such as CAPPI and TOP (Esbri et al., 2021), this new approach focuses on the most convective parts of storms by incorporating Vertical Integrated Liquid (VIL) density-based nowcasting. The VIL density product, derived from radar composites, provides vertical storm structure information in a two-dimensional format, enabling faster data processing without losing volumetric capabilities.

The obtained storm centroid distributions using the two different methodologies are discussed. The new resulting warning areas are compared with incidents from Barcelona's rainfall drainage network, managed by Barcelona Cicle de l'Aigua S.A., and the economic impacts collected by the Consorcio de Compensación de Seguros for municipalities in the Metropolitan Area of Barcelona, thereby redefining rainfall hotspots in the region.

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References:

Esbri L., Rigo T., Llasat M.C., Aznar B. Identifying Storm Hotspots and the Most Unsettled Areas in Barcelona by Analysing Significant Rainfall Episodes from 2013 to 2018. Water. 2021; 13(13):1730. <https://doi.org/10.3390/w13131730>

