

CHALLENGES IN AN EARLY WARNING OPERATING SYSTEM FOR URBAN FLOODS: A CASE STUDY OF THE CITY OF SÃO PAULO, BRAZIL

DESAFIOS EM UM SISTEMA OPERACIONAL DE ALERTAS ANTECIPADOS PARA ENXURRADAS URBANAS: ESTUDO DE CASO PARA A CIDADE DE SÃO PAULO, BRASIL

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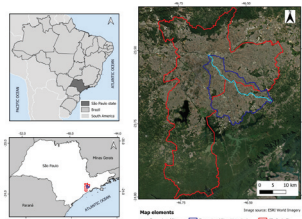


INTRODUCTION

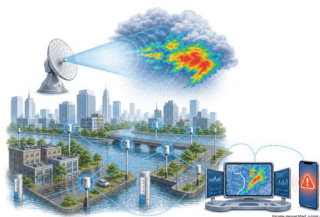
Two types of extreme events that pose major monitoring challenges are flash floods and urban flooding. These quick-onset events can happen and end within minutes, causing extensive damage to infrastructure, disrupting vital services, and endangering human safety. In both cases, precipitation is a key factor and a major source of uncertainty in hydrological research, especially regarding climate change impacts. This document outlines the main challenges in monitoring and providing early warnings for these events, based on the scientific and operational efforts of Cemaden.

STUDY AREA

The study region encompasses the Tamanduateí River Watershed (TRW), situated within the Metropolitan Region of São Paulo (RMSP), Brazil's pivotal economic zone. The TRW includes a drainage basin of 330.41 km² in area, with its primary watercourse, the Tamanduateí River, extending for 36.5 km. This sub-watershed of the Upper Tietê Hydrographic Basin (In Portuguese *Bacia Hidrográfica do Alto Tietê*) is distinguished by a high level of urbanization, with over 80% of its surface covered by impervious surfaces, thereby contributing to the frequent occurrence of flash and fluvial floods throughout the watershed.

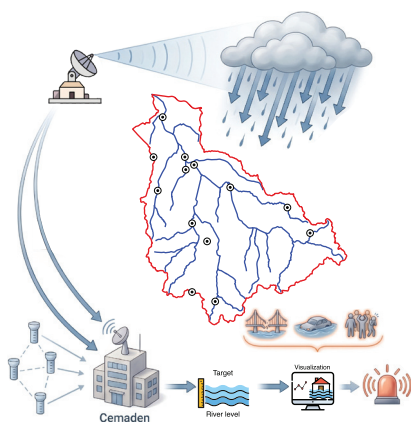


PROTOTYPE FOR A HIGH-RESOLUTION URBAN FLOOD EARLY WARNING SYSTEM



PRELIMINARY FINDINGS

Operational monitoring encounters limitations due to the sparse data collection from gauge stations, which record rainfall and water stage with low temporal resolution and limited spatial coverage. An alternative is utilizing weather radar data, providing estimates of recent events with high spatiotemporal resolution, including short-term data. However, in Brazil, weather radars do not encompass all municipalities. Additionally, predictive models require high accuracy and robustness over extended forecast periods (1 to 4 hours) to effectively address practical challenges such as delays, uncertainties, and data failures—factors often overlooked in theoretical studies. Notable efforts include comprehensive bibliographic reviews, hydrological modeling, and operational tools. A critical analysis underscores the necessity for integrated research between academia and decision-makers to promote scientific progress and to support decision-making and public policy development.



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