**Doctoral Thesis Title**: "Digital Twins and Geo-AI for Urban Resilience and Flood Risk Management in Ecuadorian Cities"

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**Abstract**:

Urban flooding in Ecuador, exacerbated by climate change, causes severe social and economic damage, underscoring the urgent need for innovative solutions to enhance prevention, risk management, and urban resilience. Despite the frequency and severity of these events, particularly in steep Andean areas and coastal lowlands, current risk management systems face significant limitations in disaster prevention, monitoring, and response. In this context, emerging technologies such as Digital Twins (DTs) and Geo-Artificial Intelligence (Geo-AI) offer new opportunities to simulate, predict, and manage flood scenarios in near real-time (Ariyachandra & Wedawatta, 2023; Yosoon, 2023).

This research proposes the development of a data-driven (DT) model integrated with geospatial artificial intelligence (Geo-AI) for flood risk management in Ecuadorian cities. The model will incorporate multi-source geospatial data—such as satellite imagery, IoT sensors, digital elevation models (DEMs), and socio-environmental indicators—to create a dynamic platform for monitoring and decision support. Urban morphological metrics, hydrological simulations using tools like SWMM (Storm Water Management Model), and machine learning algorithms will be integrated to anticipate cascading impacts on critical infrastructure (Ghaith, Yosri, & El-Dakhakhni, 2021; Ham & Kim, 2020).

The methodology consists of four main stages: (1) Collection and preprocessing of geospatial, climatic, and social data; (2) Integration and calibration of the DT model using historical flood records; (3) Technical and social validation through comparison with past events and participation of local stakeholders; (4) Construction of the DT model, integrating all functional components of the system. Unlike previous approaches, this proposal aims to adapt these technologies to Latin American urban contexts, which are often characterized by high informality and limited availability of structured data. The study will contribute to strengthening local capacities through the development of an integrated and scalable tool designed to support urban planning and emergency management in flood-prone cities (Cea & Costabile, 2022; Blokus-Dziula & Dziula, 2025).

**Available Means**: Fundación Carolina

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