Title: Flood Climate Adaptation Modeling

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The intensifying impacts of climate change, characterized by more frequent and severe weather-related disasters, are placing the real estate sector under significant pressure. To address escalating insurance premiums and potential loss of coverage in high-risk areas like the US Gulf Coast and wildfire-prone regions, it is critical to develop resilient building practices. Our climate adaptation modeling explores the potential of modeling building adaptations in future climates, providing insights into how modifications in construction practices can mitigate the risks posed by severe weather. Here, we present FEMA's recommended mitigation measures and the CoreLogic's "Climate-Coupled Catastrophe models"™ (C3™ Models) and our modeled adaptation scenarios for U.S. Flood (coastal and inland).

Using the high emissions scenario SSP5-8.5 for analyzing climate projections to show maximum impact and potential disaster scenarios, we investigated the role of building adaptations in future climates, focusing on how these modifications can reduce vulnerability and economic losses from floods. Our study employed sophisticated climate projections and housing expansion driven by population growth combined with engineering simulations to evaluate the effectiveness of various building mitigation strategies. These novel strategies include improved design code for future constructions. For this, we modelled the effects of various First-Floor Heights (FFHs) on flood losses, representing different levels of mitigation efforts (e.g., low, medium and high). CoreLogic's analysis finds that under the high emissions climate scenario, SSP5-8.5, by 2050, 100-year inland floods will become more frequent throughout the US. On average in this scenario, a 100-year inland flood event at present will become as frequent as a 20 to 60-year event in 2050, depending on the location. At the national level, there will be a 100% increase in flood risk when both hazard and population growth are considered, which approximately twice as much an increase more than when construction expansion is not considered. The proposed building code enhancements reduce flood risks across the US. Under a high mitigation approach, the percent increase in flood risk will drop from 100% to 65%.

The models generated from this research aim to provide developers, community planning officials, property owners and buyers, and policymakers with actionable insights for constructing buildings capable of withstanding future climate conditions. The research highlights the importance of forward-thinking, proactive building standards, suggesting that current construction practices may fall short of meeting the demands of a changing climate. Additionally, it identifies significant gaps in existing adaptation measures, proposing areas where further innovation and research are necessary. By modeling the impact of building adaptations on future climate resilience, this study offers valuable guidance for ensuring the durability and sustainability of real estate investments, particularly in regions most vulnerable to climate change.

The inclusion of disaster management perspectives in this study underscores the critical intersection of climate science, the full cycle of emergency management, and adaptive infrastructure planning, highlighting the FEMA's commitment to mitigating disaster impacts through evidence-based policy. Nationwide, FEMA collaborates across federal, state, and local levels to promote standards and resources that enhance community resilience to natural hazards. By providing data-driven insights on adaptive building practices, FEMA equips government agencies, developers, and insurers with practical strategies for reducing flood risks under future climate scenarios. FEMA's supplementary role in this research/paper offers a valuable perspective on the translation of climate projections into actionable developmental practices which do not exacerbate the needs of emergency management professionals across the country, illustrating how integrated disaster planning can address heightened risks from climate-induced flooding. This collaboration not only strengthens alignment across sectors but also serves as a model for how climate science can inform policies to protect lives, property, and economic stability in flood-prone regions.

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