Building Resilience: Harnessing Location Intelligence for Flood Risk Mitigation

TOM SPENCER, Australia

SUMMARY

Flooding is one of Australia's most costly and disruptive natural disasters, with climate change driving increased frequency and severity. Traditional flood models provide essential insights for risk management, but they often operate at broad geographic scales, which can limit their ability to capture the resilience of individual properties. As the need for precise flood risk assessment grows, integrating property-level building resilience characteristics offers an opportunity to enhance existing methodologies.

Geoscape Australia improves flood risk assessments by combining detailed property-level building characteristics – such as first floor elevation, building materials, and structural conditions – with industry-leading flood models. This approach provides insurers with more accurate risk-based pricing, supports governments in emergency preparedness and climate adaptation, and enables financial institutions to refine lending decisions.

By leveraging authoritative national-scale built environment insights, Geoscape enhances flood risk mitigation efforts across Australia. This property-level solution allows decision-makers to develop more targeted risk strategies, strengthen community resilience, and ensure fairer financial and policy outcomes in response to Australia's evolving flood landscape.

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INTRODUCTION

Geoscape Australia, owned by the nine governments of Australia, is dedicated to developing and facilitating the broadest possible access to authoritative national spatial datasets to deliver benefits for all Australians. Innovating in the national interest, Geoscape expands upon its understanding of the built environment of Australia to bring a deeper understanding of building resilience. This innovation aids industries across finance, insurance, and government in analysing risk and responding to the impact of natural disasters on built Australia and its population.

Flooding is one of the most costly and disruptive natural disasters in Australia, impacting homes, businesses, and critical infrastructure. As climate change accelerates, the frequency and severity of flood events are increasing, posing greater risks to communities and the economy. Governments, insurers, and financial institutions need accurate, property-level insights to assess flood risk effectively and develop resilience strategies.

Traditional flood risk assessments often rely on broad-scale models that categorise entire postcodes or regions with the same level of risk. This approach can lead to misclassifications—properties that are actually resilient may be deemed high-risk, affecting insurance premiums and financial accessibility.

Advancements in geospatial data provide an opportunity to refine flood risk analysis and enhance our understanding of resilience. By integrating high-resolution property data—including building footprints, first-floor heights, materials, and conditions—with industry-leading flood models, we can achieve a more precise understanding of a property's resilience to flood events at the individual property level.

This paper explores how Geoscape Australia's innovation contributes to flood risk management by delivering detailed location insights. It examines how integrating geospatial data with flood models can complement existing assessment methods, providing a more granular view of flood exposure at the property level. With enhanced data-driven insights, decision-makers across government, finance, and insurance sectors can refine their risk strategies, support equitable financial outcomes, and strengthen community resilience.

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THE EVOLVING LANDSCAPE OF FLOOD RISK ASSESSMENT

Flood risk assessment has evolved significantly, with insurers, government agencies, and researchers leveraging a range of sophisticated models to predict and manage risk. Advances from insurance organisations and other remote sensing providers have improved flood modelling, incorporating satellite imagery, hydrological simulations, and real-time monitoring.

While these models provide critical insights, they typically focus on broad flood patterns rather than the structural characteristics of individual properties. Many assessments rely on postcode or suburb-level flood zones, which—while valuable—may not fully capture the resilience characteristics of a building, such as first-floor elevation and building materials.

Integrating high-resolution property intelligence with existing flood models allows for a more detailed understanding of flood exposure at an individual building level. By combining building resilience insights with industry-leading flood analytics, decision-makers can refine risk assessments, ensuring more precise outcomes for planning, insurance, and emergency response.

ADVANCING FLOOD RISK ANALYSIS WITH GEOSPATIAL DATA

Geoscape's Property Intelligence provides comprehensive and customisable data on individual properties across Australia, enabling precise and data-driven decision-making. This solution integrates various types of property data, including addresses, cadastre, building footprints, building materials, conditions, elevations, and first floor elevation, to deliver actionable insights tailored to the needs of different stakeholders.

Geoscape Buildings provides detailed insights on every building in Australia, derived from satellite and aerial imagery. This dataset includes attributes such as floor area, building heights, roof type, land zoning, and indicators for solar panels and swimming pools.

Through an ongoing collaboration with GeoX, an AI-driven geospatial analytics company, Geoscape continues to enhance our national understanding of the resilience of the built environment. This partnership drives continuous innovation, leveraging advanced machine learning and computer vision to extract highly detailed building characteristics. By integrating these insights, we can better assess and improve the resilience of buildings across Australia, aiding in more effective flood risk management and disaster response strategies.

The latest addition to this evolving dataset is First Floor Elevation, the lowest habitable floor height above ground, derived from terrestrial imagery. This groundbreaking feature provides

an unprecedented level of insight into flood risk assessment, helping insurers, governments, and financial institutions make more precise, data-driven decisions. With regularly updated and enriched data, Geoscape Buildings remains a vital resource for applications in insurance risk analytics, emergency response management, urban planning, acoustic modelling, and research studies.

Geoscape's Advanced Flood Analytics integrates industry-leading flood models with our insight on the location and the resilience of buildings at every property enhancing the accuracy of flood risk assessments. This solution advances our collective understanding of the risk and impact of flood events in Australia through:

1. Applying flood model insights at the location of the building with the context of the building shape and the underlying elevation. Advancing upon industry wide use of G-NAF locations which provide a point location at a property with the geocode most commonly at the front setback or centroid of the parcel without context of the position of the building.

2. Integrating a deeper understanding of building resilience into the analysis including attributes on the first floor elevation, presence of property below the entry e.g. a basement or garage, wall materials and condition, and average flood depths across standard flood return periods.

3. Analysing the resilience in the context of average flood depths across standard flood return periods to inform on the risk to property significantly reduces the number of at-risk properties identified and enables a greater focus on those properties that truly are at risk of inundation. Initial analysis has identified across flood risk Australia including a consideration of the attributes of building resilience into flood models will reduce the number of buildings likely to inundate from floods by 10-20% for multiple return periods, this is in addition to identifying those properties with minor levels of inundation that may be considered to have significant inundation without consideration of building resilience.

This enhanced analysis leads to greater accessibility to financial products including insurance and mortgages to property owners with resilient homes currently identified with high flood risk through traditional modelling approaches. This innovation further informs planning, disaster response, and equitable service delivery nationwide.

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KEY APPLICATIONS AND USE CASES

1. **Governments: Strengthening Planning and Emergency Management**

   1.1. Improve Emergency Preparedness: Identify high-risk areas with greater precision, allowing emergency services to optimise resource allocation and disaster response planning.

   1.2. Support Climate Adaptation Policies: Leverage property-level flood insights to develop data-driven policies that enhance resilience, inform grant funding, and support mitigation programs.

2. **Banks: Enhancing Mortgage Risk Assessment**

   2.1. Refine Lending Decisions: Assess flood exposure beyond aggregated risk zones, ensuring a more precise understanding of an individual property's resilience.

   2.2. Improve Portfolio Risk Management: Analyse large-scale mortgage portfolios with enhanced flood intelligence to identify exposure trends and potential financial risks.

3. **Insurers: Advancing Underwriting and Pricing Accuracy**

   3.1. Refine Risk-Based Pricing: Move beyond generalised flood zones to price policies more accurately based on first-floor elevation, building materials, and other resilience factors.

   3.2. Expand Coverage Accessibility: Identify properties with low flood exposure that may have previously been categorised as high risk, potentially improving affordability and coverage availability.

   3.3. Enhance Claims Management: Utilise precise location intelligence to verify claims, assess post-event damage, and support rapid response efforts.

CASE STUDY

The Australian Prudential Regulation Authority (APRA) initiated the Insurance Climate Vulnerability Assessment (Insurance CVA) to examine how climate change could impact household insurance affordability in Australia. The assessment, conducted in collaboration with the country's top five insurers, evaluates the potential effects of two climate scenarios on future insurance costs for free-standing residential properties.

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As part of this initiative, Geoscape Australia provided its location intelligence expertise, offering a tailored solution that aligned with APRA's requirements. Geoscape's support enables site-specific risk assessment, facilitating more accurate underwriting, pricing strategies, and risk mitigation planning.

CONCLUSION

As the changing climate increases the frequency and severity of floods in Australia, accurate and granular flood risk assessments are more critical than ever. Traditional models provide essential insights but often lack the property-level detail needed for precise decision-making. By integrating high-quality geospatial data with industry-leading flood models, stakeholders can refine risk assessments, ensuring more informed planning, insurance, and financial decisions.

Geoscape Australia's innovation enables governments to strengthen emergency preparedness, banks to enhance mortgage risk assessments, insurers to refine underwriting and pricing, and communities to build resilience. By leveraging detailed location intelligence, decision-makers can move beyond broad risk classifications to a more targeted, data-driven approach. This shift not only improves risk mitigation strategies but also ensures fairer outcomes for homeowners, businesses, and policymakers navigating Australia's evolving flood landscape.

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