ZURICH
Resilience Solutions

Impact of Climate Hazards on Major Sea Cities in South East Asia

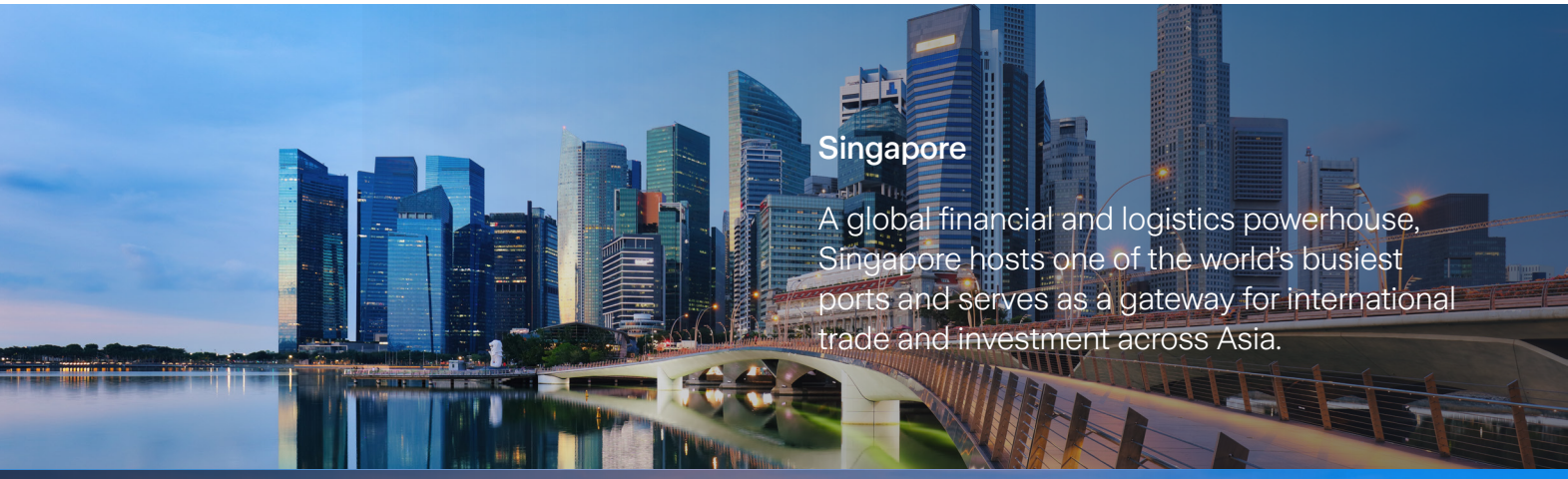
Discover our Insights

Climate change presents an escalating threat to urban centers worldwide, with Southeast Asia among the most vulnerable regions due to its dense populations, coastal geography, and dependence on climate-sensitive infrastructure.

The region's major sea cities; **Singapore, Jakarta, Manila, Bangkok, Ho Chi Minh City,** and **Kuala Lumpur** are vital to global trade, finance, and logistics, yet increasingly exposed to climate-related disruptions.

What are the economic drivers of Southeast Asia's major sea cities?

These coastal urban centers are critical engines of regional and global economic activity. Each city plays a distinct role in driving trade, innovation, and industrial growth.

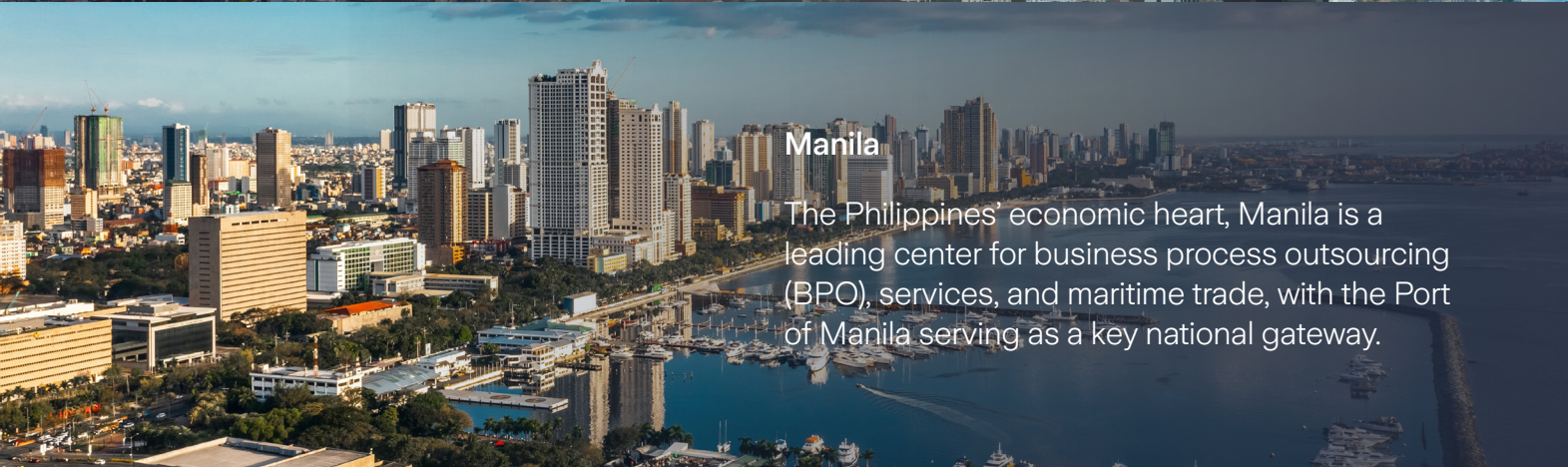


Singapore

A global financial and logistics powerhouse, Singapore hosts one of the world's busiest ports and serves as a gateway for international trade and investment across Asia.

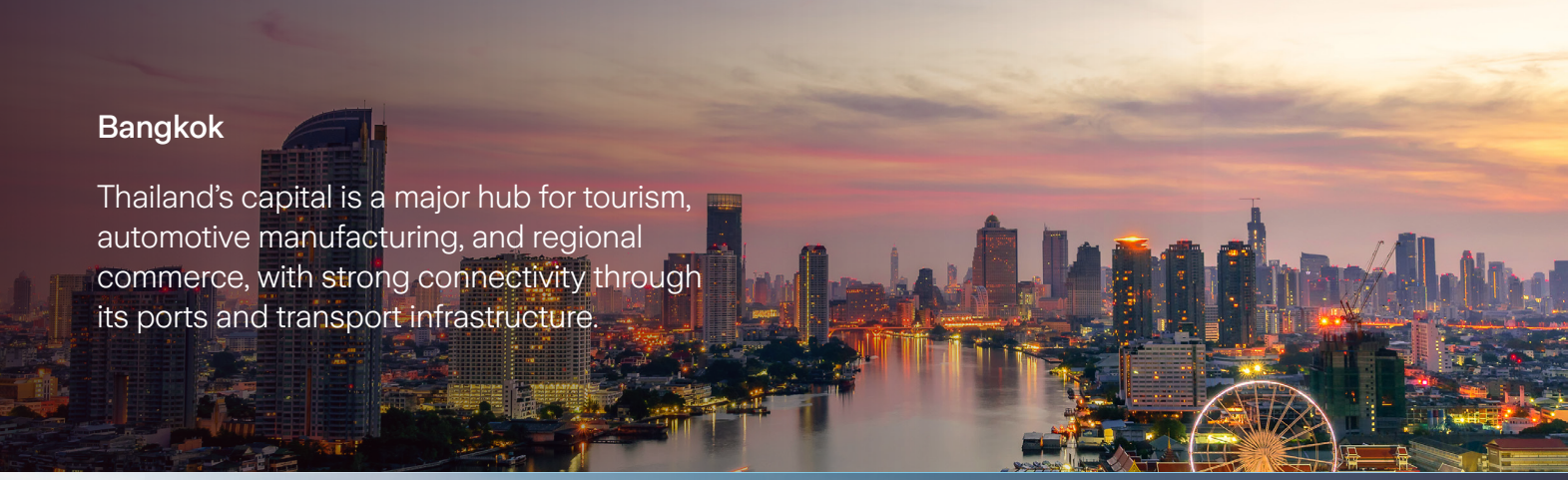
Jakarta

As Indonesia's capital and largest city, Jakarta anchors the nation's economy through its concentration of manufacturing, finance, and infrastructure development, supported by the strategic Port of Tanjung Priok.



Manila

The Philippines' economic heart, Manila is a leading center for business process outsourcing (BPO), services, and maritime trade, with the Port of Manila serving as a key national gateway.

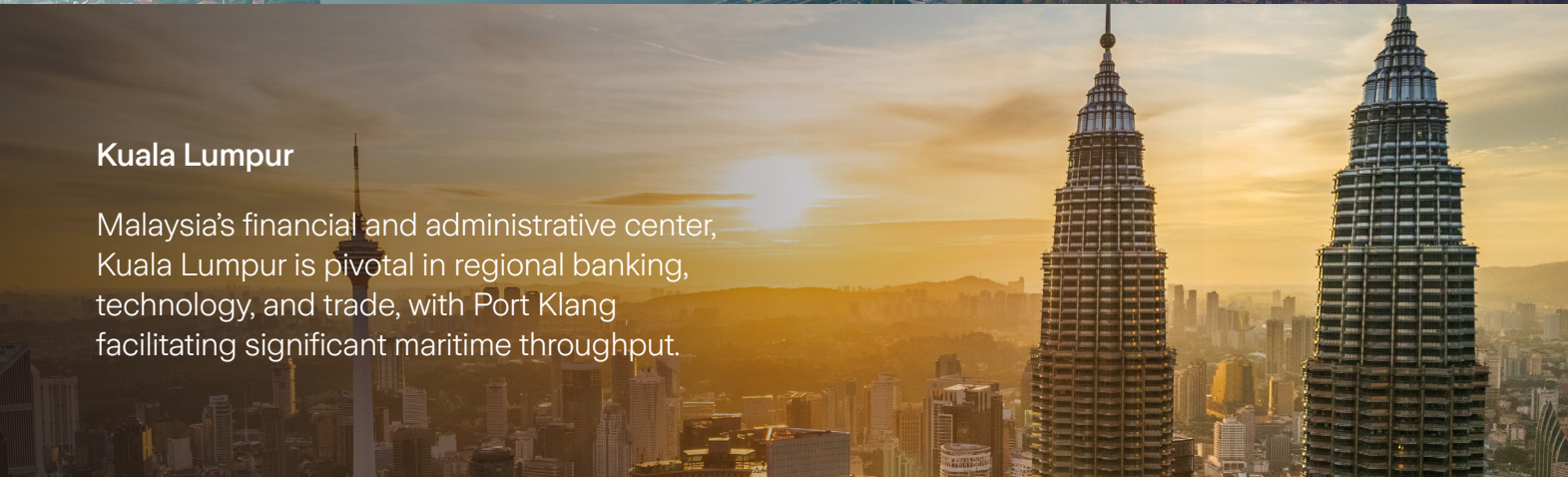


Bangkok

Thailand's capital is a major hub for tourism, automotive manufacturing, and regional commerce, with strong connectivity through its ports and transport infrastructure.

Ho Chi Minh City

Vietnam's commercial capital drives the country's export-led growth, particularly in textiles, electronics, and consumer goods, supported by rapid urbanization and foreign investment.



Kuala Lumpur

Malaysia's financial and administrative center, Kuala Lumpur is pivotal in regional banking, technology, and trade, with Port Klang facilitating significant maritime throughput.

Together, these cities form an economic corridor that is essential to Southeast Asia's integration into global markets. Their continued growth and resilience are vital not only to regional prosperity but also to the stability of international supply chains and investment flows. spaces. This combination creates conditions for additional fire hazards, including runaway triggered by overheating.

In response to this growing risk, Zurich Resilience Solutions conducted a targeted analysis of physical climate hazards affecting these cities. Utilizing our forward-looking, proprietary data models, we evaluated exposure to key threats including coastal flooding, sea-level rise, extreme heat, and windstorms.

What climate risks do Southeast Asia's sea cities face?

Singapore, Jakarta, Manila, Bangkok, Ho Chi Minh City, and Kuala Lumpur are on the frontlines of climate change. As revealed by our comprehensive hazard analysis, these urban centers face a convergence of escalating threats: rising seas, intensifying heatwaves, extreme precipitation, and persistent flooding.

Each city's risk profile is shaped by its geography, infrastructure, and urban density. Coastal zones are increasingly vulnerable to storm surge and sea level rise, while inland urban cores grapple with heat stress, water scarcity, and flash flooding. The analysis underscores a sobering reality: no zone is immune, and climate hazards are intensifying across all timeframes.

The implications are profound. These cities anchor global supply chains, financial systems, and innovation networks. Their exposure to climate disruption is not just a regional concern - it's a global risk. Yet within this challenge lies opportunity. By investing in localized resilience strategies, from stormwater infrastructure and heat mitigation to adaptive zoning and emergency preparedness, Southeast Asia can lead the way in climate adaptation.

This is not merely about protecting assets - it's about safeguarding lives, livelihoods, and long-term prosperity. The path forward demands collaboration across sectors, data-driven planning, and bold leadership. Southeast Asia's sea cities have the potential to become models of urban resilience in a warming world.

How are cities building climate resilience?

Singapore is pioneering nature-based solutions and coastal protection infrastructure, including the ambitious Coastal Protection and Flood Resilience Program. Its Green Plan 2030 integrates climate adaptation with urban sustainability, targeting carbon neutrality and enhanced water resilience.

Jakarta, facing existential threats from land subsidence and sea level rise, is investing in the Giant Sea Wall project and exploring urban relocation strategies. The city is also expanding green infrastructure and early warning systems to mitigate flood and heat risks.

Manila is advancing multi-hazard preparedness through the Metro Manila Flood Management Project, which includes pumping stations, improved drainage, and community-based resilience planning. Efforts to integrate climate-smart urban design are gaining traction in new development zones.

Bangkok is leveraging elevated infrastructure, urban wetlands, and smart water management systems to counteract flood risks. The city's Bangkok Resilience Strategy emphasizes climate adaptation, public health, and inclusive governance.

Ho Chi Minh City is implementing zoned resilience planning, with targeted upgrades to stormwater systems, heat mitigation, and green corridors. The city is also aligning with Vietnam's national climate goals, including net-zero by 2050.

Kuala Lumpur, while inland, is responding to rising heat and drought with urban greening, water conservation programs, and climate-responsive building codes. The city's Low Carbon Cities Framework supports long-term sustainability and resilience.

A city-by-city analysis of climate hazards

The analysis was conducted under the SSP2-4.5 scenario, a widely used climate projection developed by the Intergovernmental Panel on Climate Change (IPCC). This “middle-of-the-road” pathway assumes moderate global mitigation efforts and anticipates a 2°C warming by 2041–2060, aligning with the net-zero transition plans of many countries.

Each hazard is assessed across four severity levels based on projected intensity, frequency, and potential impact:

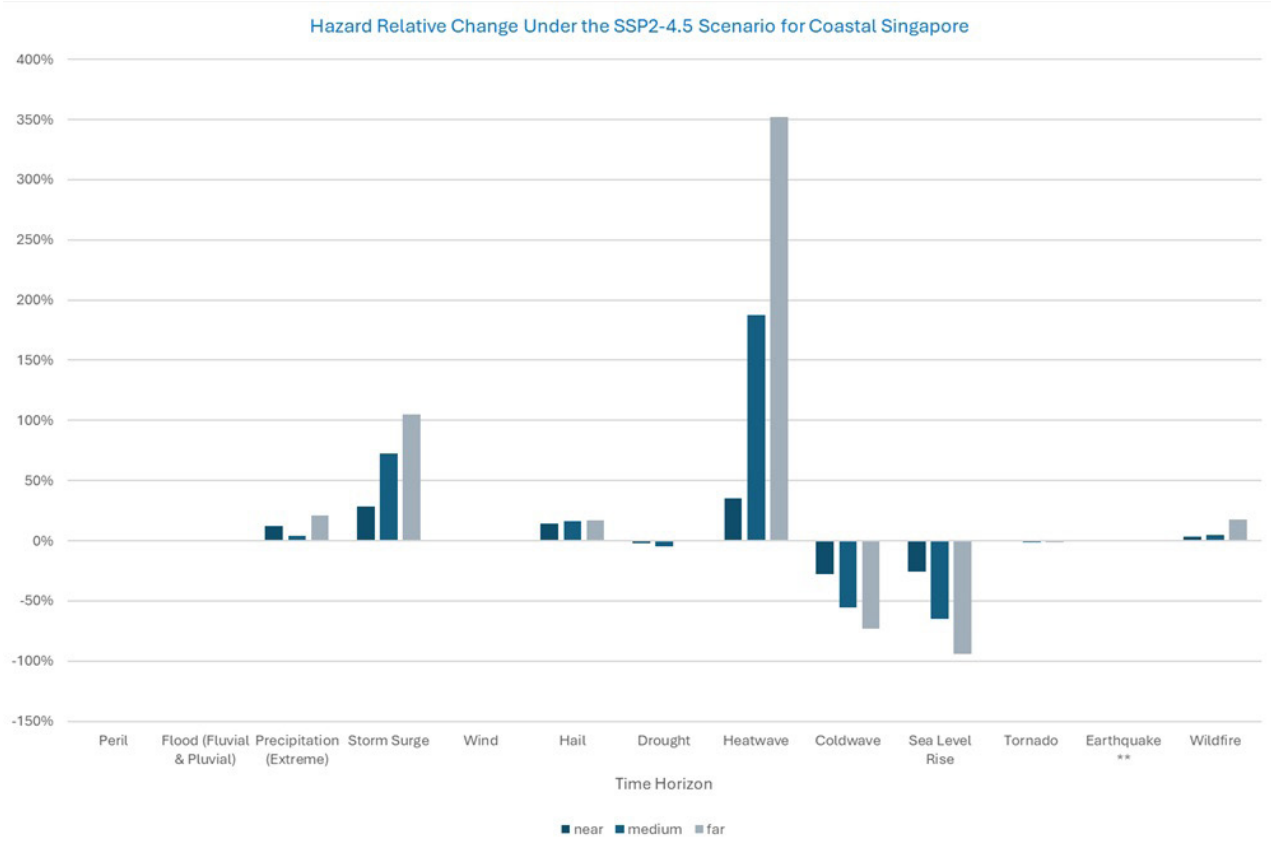
Low | Medium | High | Very high

SINGAPORE

Our climate hazard analysis reveals distinct yet interconnected climate risk profiles for Singapore's coastal and central regions.

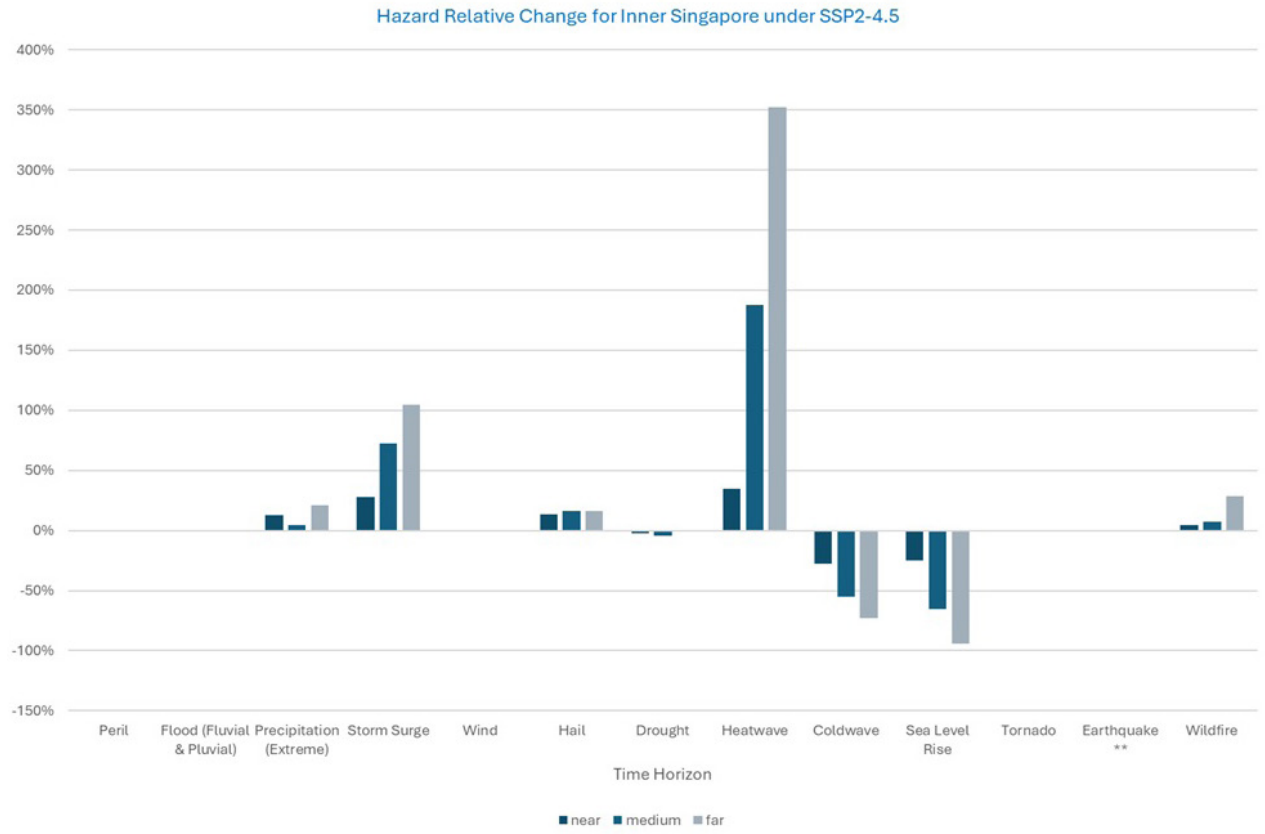
Coastal Singapore faces escalating threats from storm surge and sea level rise, with surge heights projected to double from 0.45m to 0.92m and sea level rise consistently rated *very high* across all future time horizons. This reflects rising ocean levels and a relative decrease in land elevation profiles, amplifying the exposure of low-lying coastal infrastructure to inundation risks.

Extreme precipitation remains a persistent hazard, intensifying from 388mm to 470mm in 24-hour events, while heatwaves, currently minimal, are expected to become very high, reflecting growing thermal stress.



In contrast, **central Singapore,** although less exposed to direct coastal threats, shows significant vulnerability to heatwaves, with durations increasing from 7 to over 32 days, and extreme precipitation reaching up to 477mm. Storm surge also intensifies here, albeit slightly less than in coastal zones. Notably, hail and wildfire hazards show marked increases in both areas, while drought trends diverge: moderate and stable in coastal zones but fluctuating in central areas.

Together, these findings underscore the urgent need for localized resilience strategies tailored to each zone's exposure profile. Coastal defences, heat mitigation, and stormwater infrastructure will be critical to safeguarding Singapore's urban systems against intensifying climate risks.

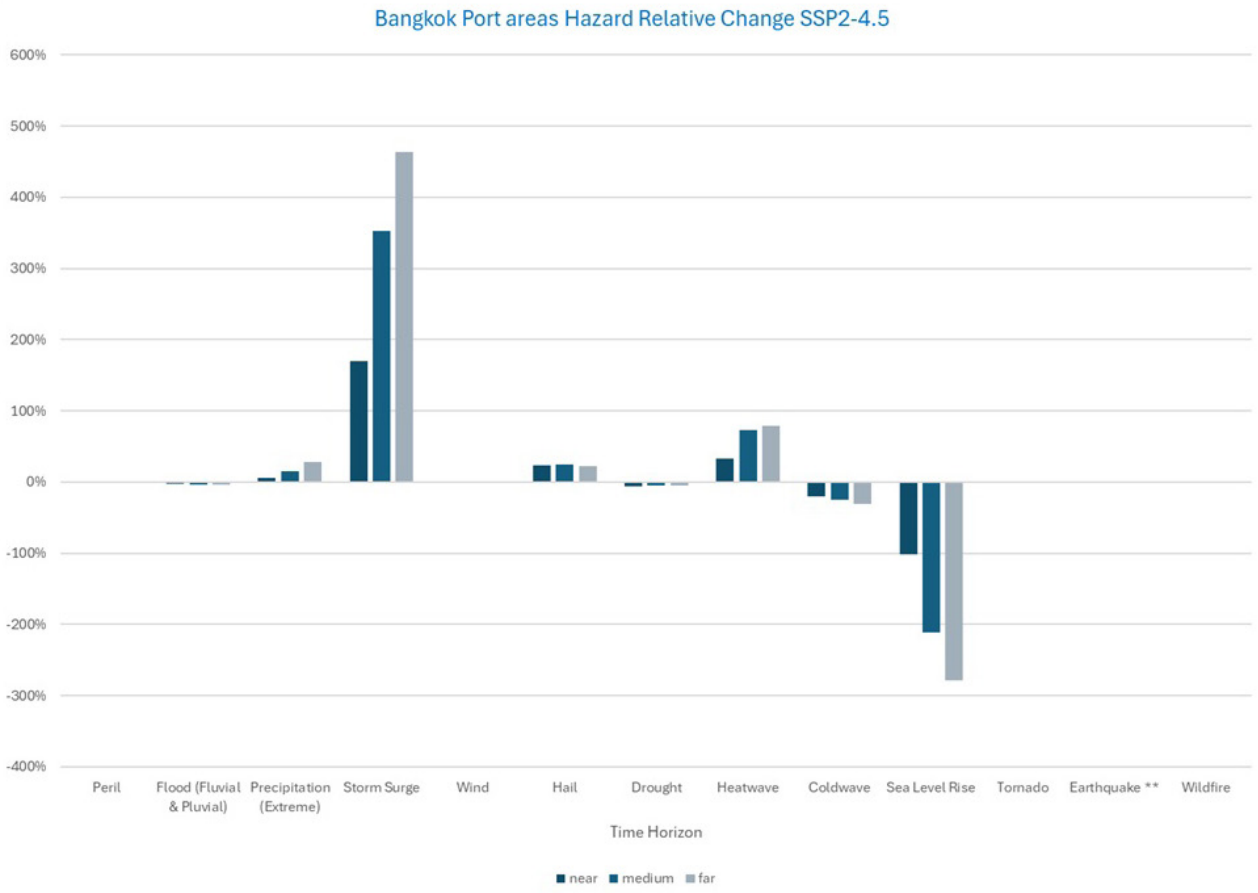


BANGKOK

Bangkok's vulnerability to climate hazards varies significantly between its port areas and inner urban core, reflecting differences in geography, elevation, and infrastructure exposure - although both zones face intensifying risks.

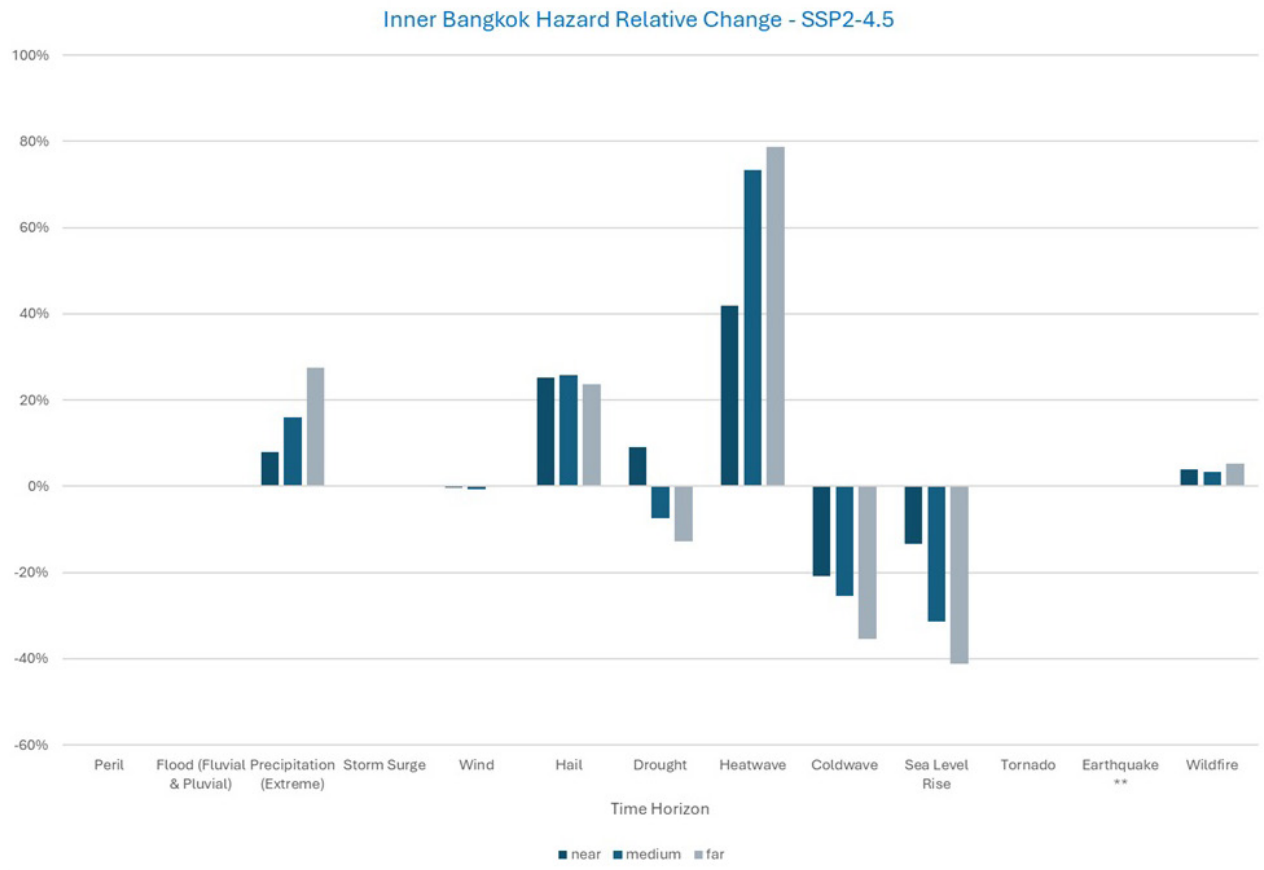
Bangkok's port districts are increasingly exposed to storm surge, with projected heights rising from 0.30m to 1.78m, marking a 491 percent increase. This surge, coupled with consistently *very high* sea level rise ratings, reflects a relative decline in land elevation profiles, amplifying flood risks in low-lying coastal zones. Fluvial and pluvial flooding remains high, with water depths around 1.41–1.49m, while extreme precipitation intensifies from 209mm to 258mm, stressing drainage systems and port operations.

Heatwaves are rated very high throughout, and hazards like hail, drought, and tornadoes show moderate increases. Despite some fluctuations in sea level rise values, the overall hazard remains *severe* due to regional vulnerability and elevation shifts.



Inner Bangkok, while less exposed to coastal hazards, faces mounting urban climate pressures. Heatwaves are a dominant threat, with durations increasing from 20 to 47 days, indicating sustained thermal stress on residents and infrastructure. Extreme precipitation rises from 205mm to 255mm, contributing to urban flood risks despite *low* flood hazard ratings, likely due to elevation and drainage capacity.

Hail intensity increases steadily, with hailstone size growing from 1.54cm to 2.20cm, and drought remains high, with durations extending beyond 12 months. Sea level rise, though less critical inland, still registers a *very high* hazard rating in the far future, reflecting broader regional impacts.



HO CHI MINH CITY

Ho Chi Minh City faces a complex and intensifying climate risk landscape, with both its port areas and urban center exposed to distinct but overlapping hazards. Our analysis highlights the urgent need for zone-specific resilience strategies to address the city's evolving vulnerabilities.

Ho Chi Minh City's port districts are under sustained pressure from very high flood risk, with fluvial and pluvial flood depths increasing from 2.63m to 2.89m. This trend, coupled with very high levels of extreme precipitation - rising from 384mm to over 450mm in 24-hour events - poses a serious threat to port infrastructure, logistics operations, and surrounding communities.

Heatwaves, while initially rated *very high*, remain a significant concern with durations increasing from 14 to over 35 days, despite a slight drop in hazard level to high in the long term. Hail intensity also rises, with hailstone size growing from 1.54cm to 1.90cm, and drought durations fluctuate between 10.37 and 8.83 months, maintaining a *medium* hazard level. Other hazards such as wind, coldwave, tornado, and wildfire remain stable at low to medium levels. Storm surge and sea level rise are marked as not applicable, likely due to the port's riverine location.

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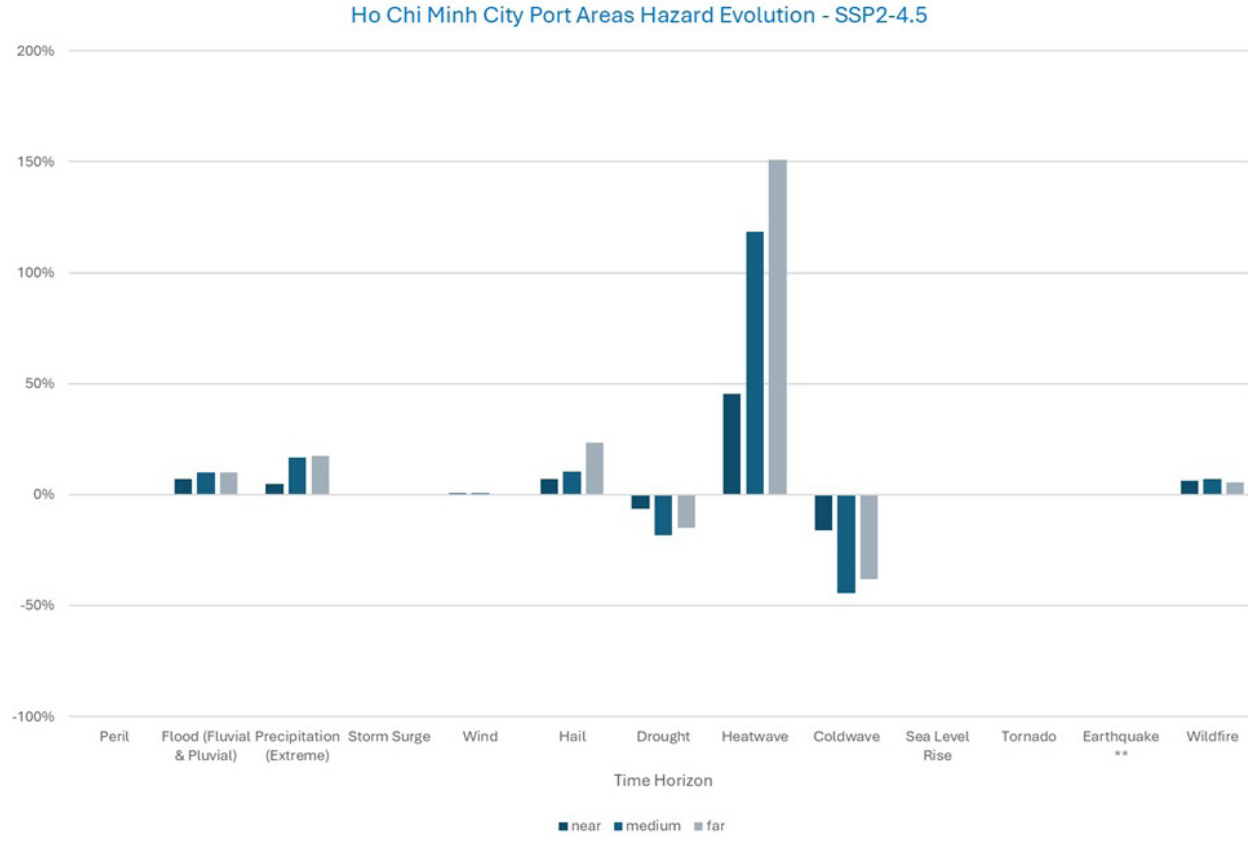
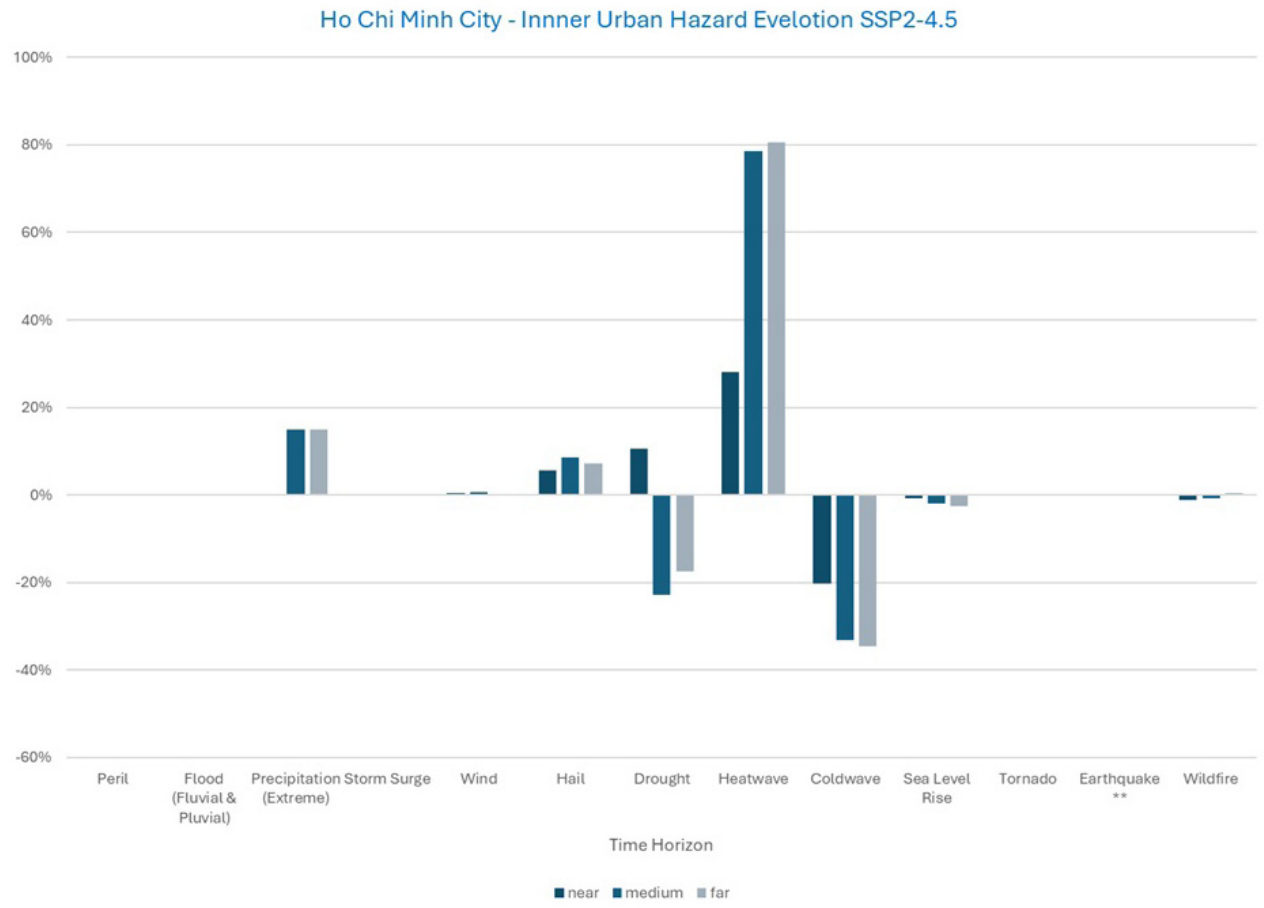


In **Ho Chi Minh's urban core,** extreme precipitation is also rated very high, with rainfall intensities increasing from 399mm to 458mm, stressing urban drainage systems. Despite this, flood hazard levels remain *low,* likely due to elevation or infrastructure resilience.

Heatwaves are a dominant and growing threat, with durations rising from 13 to over 23 days, and hazard levels consistently rated *very high*. Drought remains a persistent issue, with durations exceeding 10 months and projected to increase, indicating long-term water stress. Hail and wildfire hazards show moderate increases, while storm surge, wind, tornado, and earthquake risks remain low and stable.

Sea level rise, while not an immediate threat to the urban core due to its elevation (14.46m above sea level), still shows increasing hazard levels over time, reflecting broader regional impacts and potential indirect effects on groundwater and drainage systems.

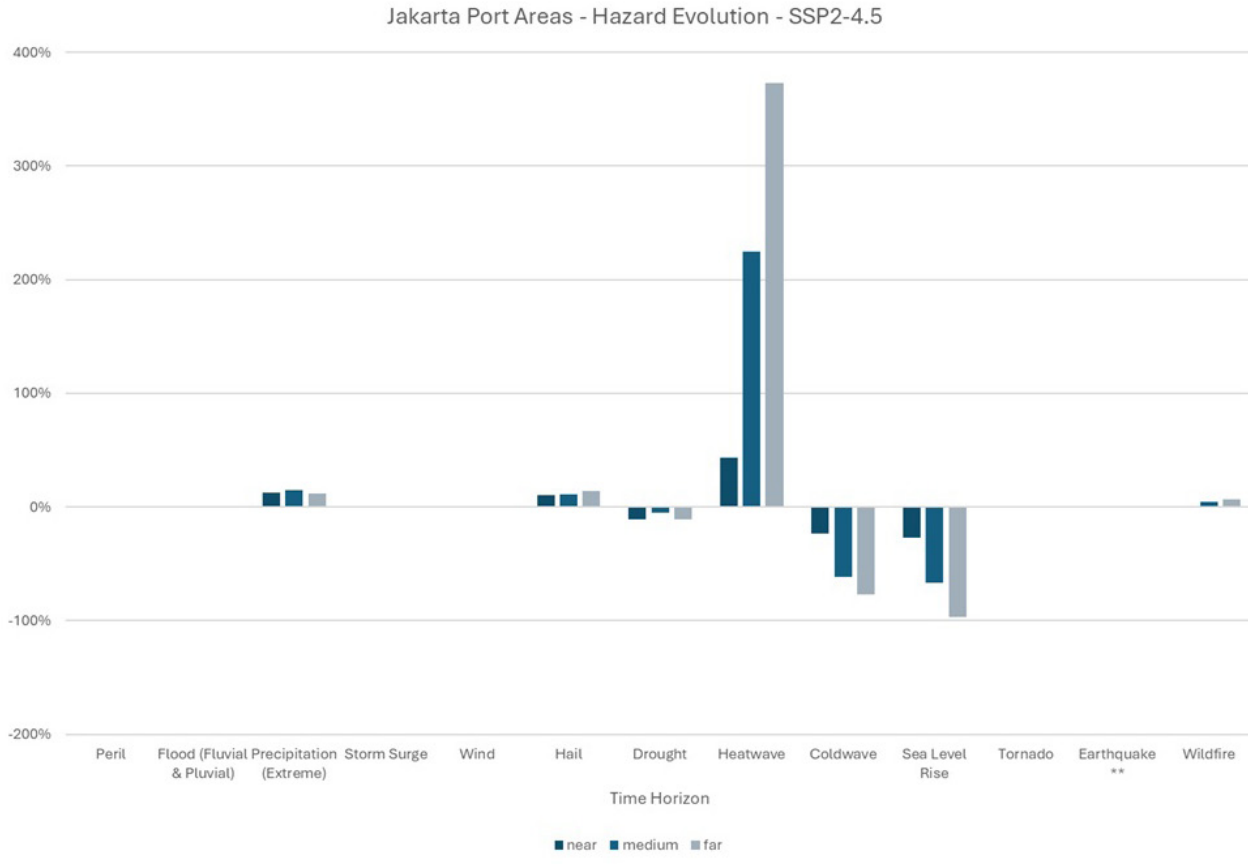


JAKARTA

Jakarta, one of Southeast Asia's largest and most climate-vulnerable cities, faces mounting risks across both its port areas and urban core. Our analysis reveals a shared exposure to flooding, extreme precipitation, and sea level rise, compounded by land subsidence and rapid urbanization.

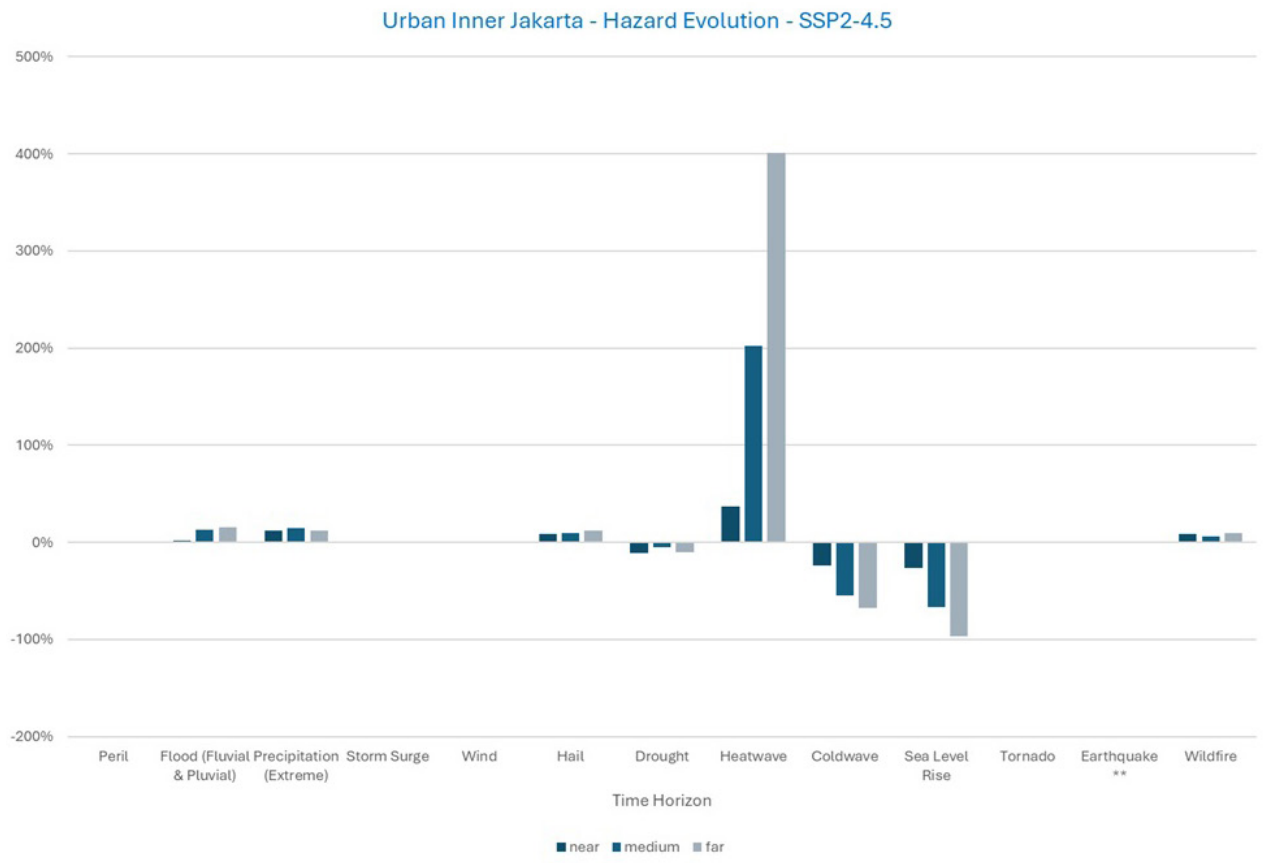
Jakarta's port districts are under sustained threat from very high fluvial and pluvial flooding, with hazard levels remaining elevated across all future scenarios. The city's low elevation and subsiding land amplify the impact of extreme precipitation, which is also rated *very high*, with rainfall intensities projected to increase significantly.

Sea level rise is a critical concern, consistently rated *very high*, reflecting the dual pressure of rising seas and sinking land. Storm surge, currently medium, is expected to intensify, further stressing coastal infrastructure. Heatwaves are rated *high* to *very high*, with increasing durations affecting port operations and worker safety. Drought, hail, and wildfire hazards show moderate increases, while wind, coldwave, tornado, and earthquake risks remain stable.



Jakarta's inner city faces similarly high exposure to flooding, with depths increasing from 1.43m to 1.65m—a 15.4 percent rise by the far future. This reflects the city's chronic drainage challenges and vulnerability to seasonal inundation. Extreme precipitation remains *high*, contributing to flash flood risks and infrastructure strain.

While detailed data for other hazards is limited, consistent high ratings across categories suggest broad exposure to climate extremes. Heatwaves are expected to intensify, exacerbating urban heat island effects and public health risks. The city's inland location offers limited protection from sea level rise, which still poses indirect threats through groundwater intrusion and drainage backflow.

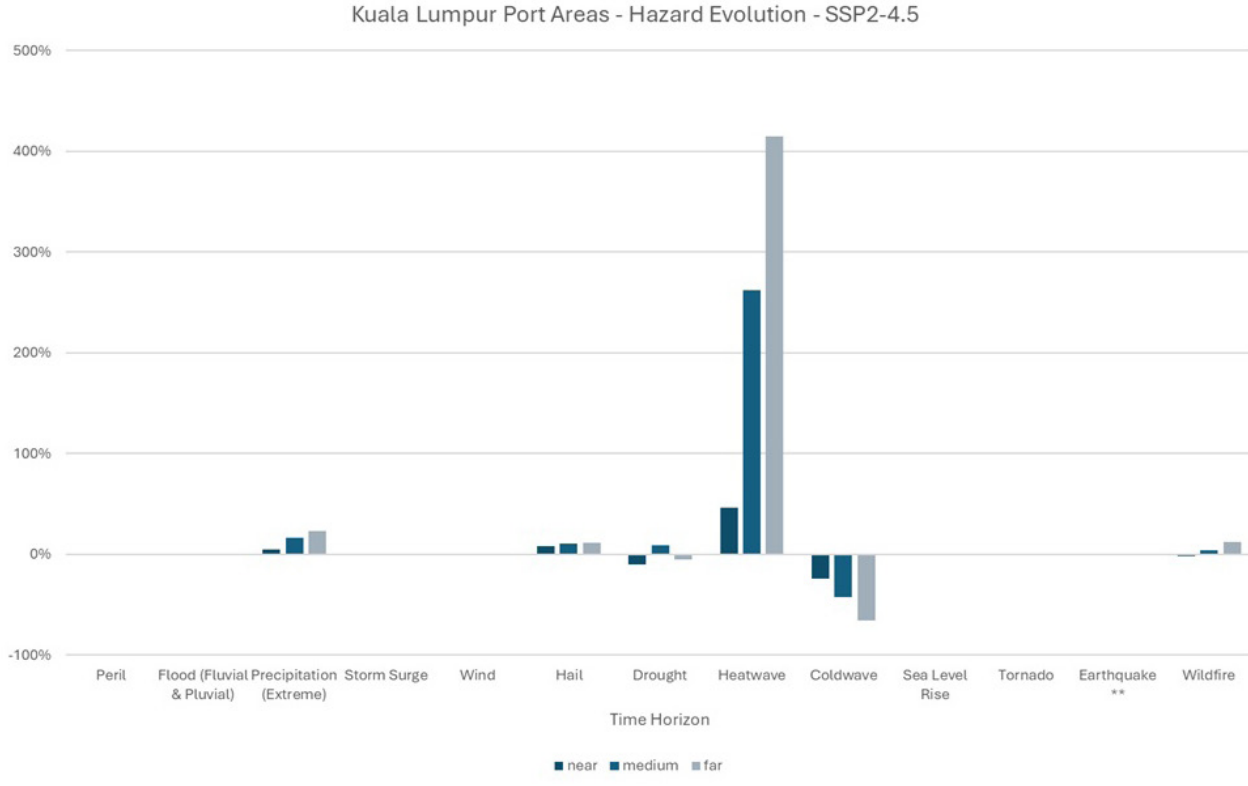


KUALA LUMPUR

Kuala Lumpur, while geographically insulated from coastal hazards due to its inland location, faces intensifying climate risks across both its port areas and urban core. Our analysis highlights growing exposure to heatwaves, drought, and extreme precipitation, which pose significant challenges to infrastructure, public health, and urban systems.

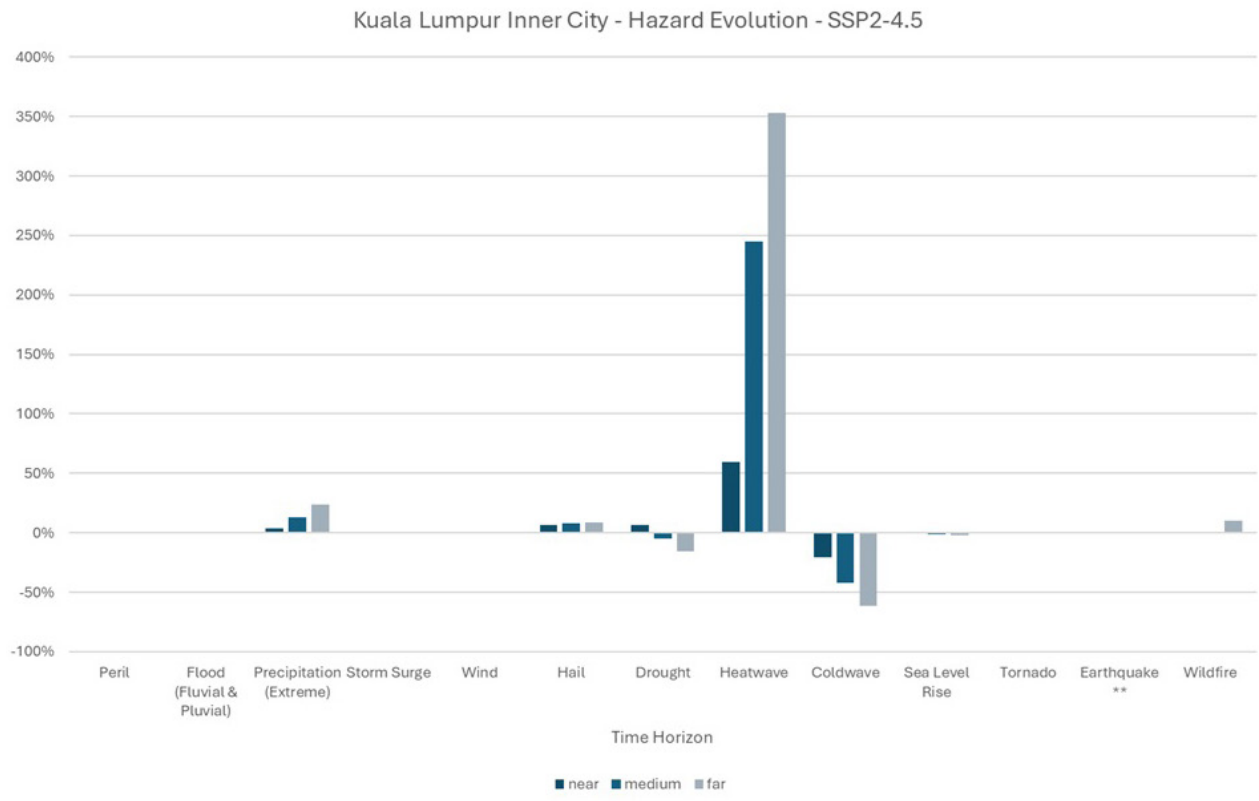
Kuala Lumpur's port zones are increasingly affected by heatwaves, with hazard levels rising from *medium* to *very high* in the medium and far future. This reflects a sharp increase in thermal stress on logistics operations, workers, and energy systems. Drought is consistently rated *very high*, with fluctuating but elevated durations, indicating long-term water stress that could impact supply chains and industrial activity.

Extreme precipitation is rated *high,* with rainfall intensities increasing from 220mm to 256mm, stressing stormwater systems and increasing the risk of localized flooding. However, fluvial and pluvial flood hazard levels remain *low,* likely due to elevation and infrastructure. Other hazards such as hail, wind, and wildfire remain low to medium, with minimal projected changes. Storm surge and sea level rise are marked as not applicable, consistent with the city's inland geography.



Kuala Lumpur's urban center mirrors many of the port area trends but with even sharper increases in heatwave intensity. Hazard levels rise from *medium* to *very high*, with durations increasing by up to 445 percent, signaling a major urban heat island effect and growing public health risks.

Drought remains a dominant hazard, rated very high across all timeframes, with durations exceeding 12 months and projected to increase further. Extreme precipitation continues to rise, with 24-hour rainfall intensities increasing by 227 percent, placing pressure on urban drainage and flood management systems. Hail shows a modest increase in severity, while other hazards such as wind, coldwave, tornado, earthquake, and wildfire remain stable or low.



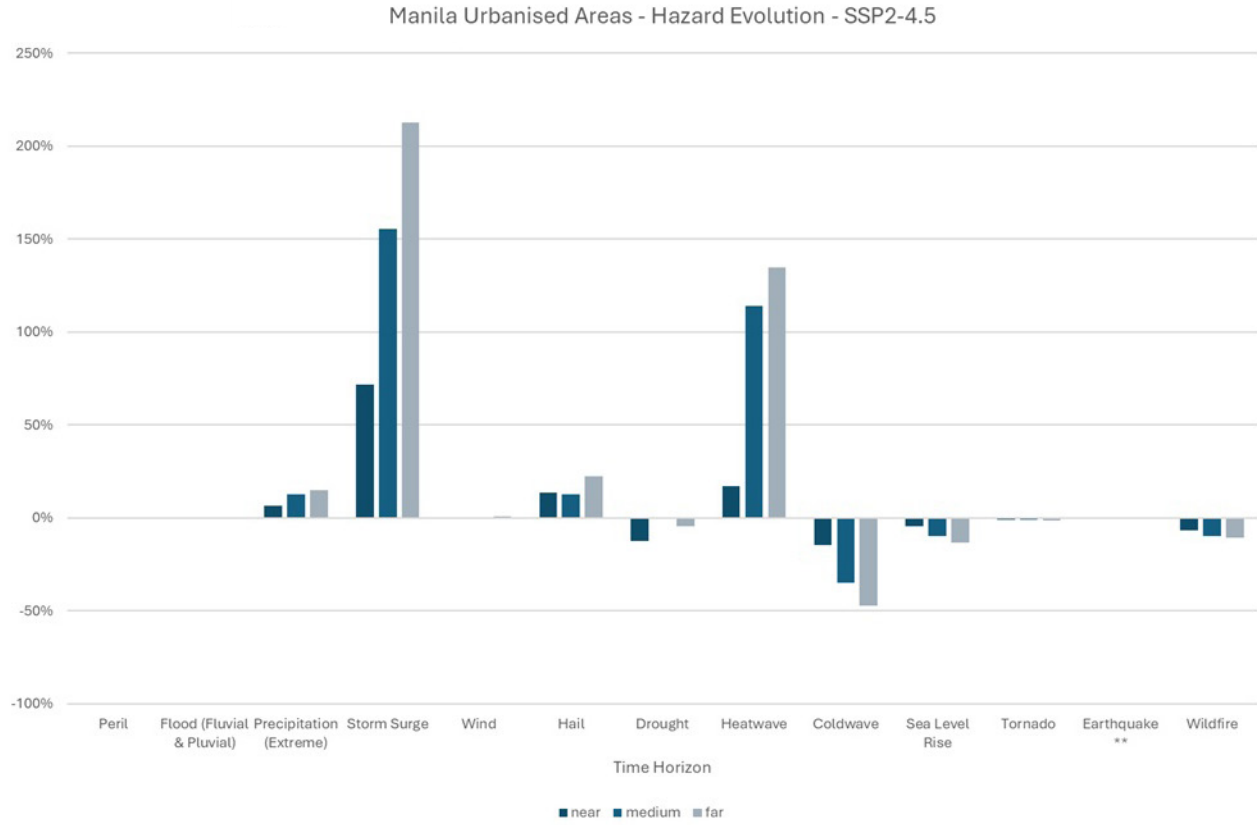
MANILA

As climate volatility intensifies across Southeast Asia, Manila stands at a critical juncture where the pressures of rapid urbanization intersect with the vulnerabilities of a low-lying coastal metropolis. Our climate hazard analysis reveals a compelling narrative: Manila's future resilience hinges on its ability to address distinct but interconnected climate risks across its urban core and port zones.

Manila's inland districts are increasingly defined by thermal stress, water scarcity, and flash flood potential. Heatwaves, once seasonal anomalies, are now prolonged events lasting over 20 days and rated very high in hazard severity. This trend is not merely a discomfort; it's a systemic threat to public health, energy reliability, and urban productivity.

Extreme precipitation, with intensities exceeding 300mm in 24-hour periods, continues to challenge drainage infrastructure. While flood hazard levels remain *moderate* to *high*, the real risk lies in the compounding effects of impermeable surfaces, informal settlements, and aging systems.

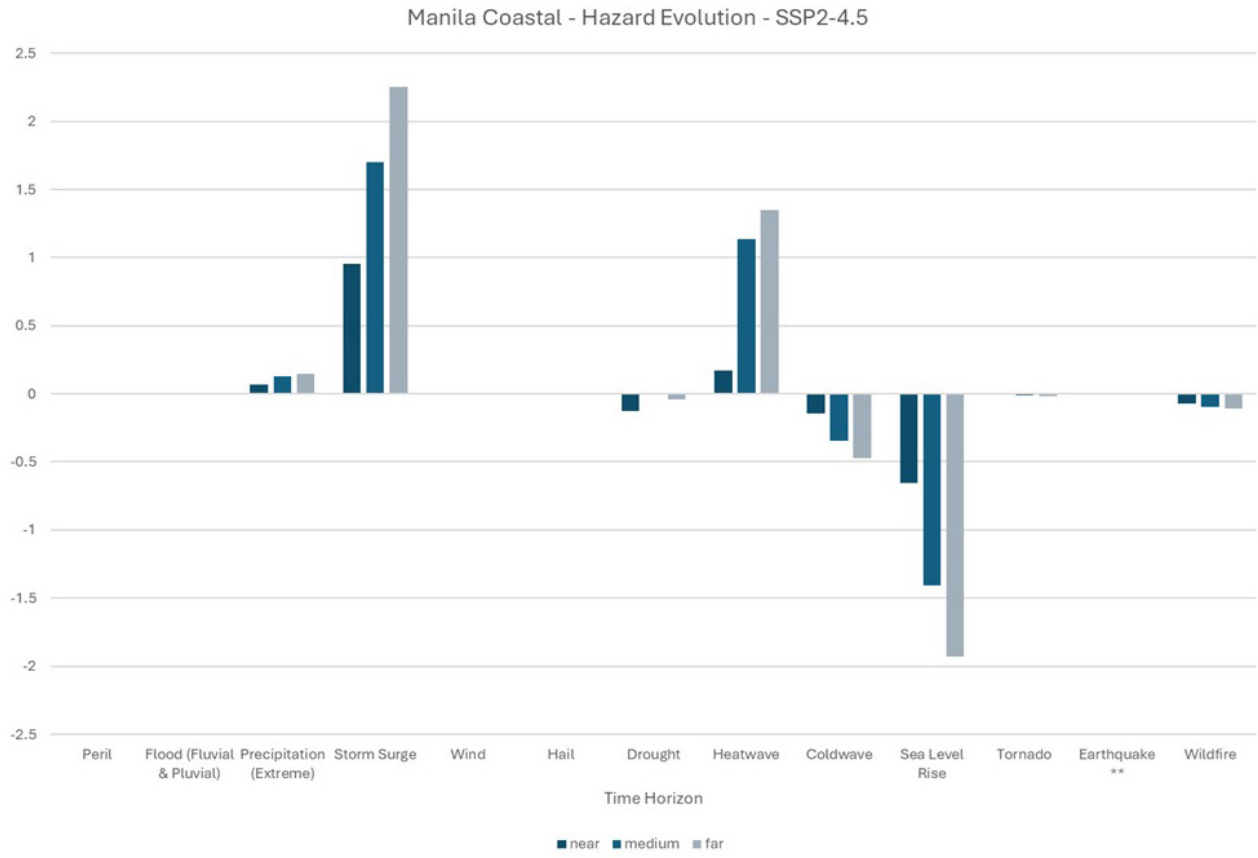
Drought, often overlooked in humid climates, is emerging as a silent disruptor. With dry spells projected to last up to 10 months, Manila faces mounting pressure on water supply, urban greenery, and food systems - especially in peri-urban zones.



Manila's port areas are the city's economic lifeline - and its climate frontline. Here, the hazards are more immediate and more severe. Storm surge heights are projected to nearly double, from 0.45m to 0.88m, threatening critical infrastructure and coastal communities. Sea level rise, rated *very high*, compounds this risk, exacerbating tidal flooding and undermining drainage systems.

Extreme rainfall intensities in port zones are even higher than inland, reaching nearly 500mm in 24-hour events. Combined with *High* wind hazards, these conditions pose serious operational and safety risks for logistics and maritime industries.

Emerging threats such as tornadoes, wildfires, and earthquakes are also escalating in severity, underscoring the need for multi-hazard preparedness and adaptive infrastructure.



Quality data is key to climate risk analysis

Localized insights

Our analysis distinguishes between port zones and urban cores, revealing how geography, elevation, and infrastructure shape hazard exposure. This precision allows for tailored resilience strategies.

Scenario-based planning

By modeling hazards under SSP2-4.5 (a moderate warming scenario), the tool supports forward-looking decisions aligned with global net-zero goals and regulatory frameworks like TCFD and CSRD.

Comparative risk profiling

Cities can benchmark their vulnerabilities across timeframes and hazard types, enabling prioritization of investments in infrastructure, emergency preparedness, and climate adaptation.

Actionable intelligence

Our analysis informs mitigation pathways, from stormwater upgrades and heat mitigation to zoning reforms and coastal defenses.

In an era of accelerating climate volatility, understanding and anticipating risk has become a strategic imperative. Nowhere is this more urgent than in Southeast Asia's sea cities, where economic vitality is inseparable from environmental vulnerability.

By harnessing proprietary climate data and IPCC-aligned scenario modeling, our Climate Spotlight Tool delivers the granular insights needed to assess hazards such as coastal flooding, extreme heat, storm surge, and sea level rise—empowering decision-makers to strengthen resilience where it matters most.

How is Zurich Resilience Solutions engineering climate resilience for a changing world?

Zurich Resilience Solutions is the specialized risk advisory arm of the Zurich Insurance Group, dedicated to helping organizations build long-term resilience in the face of evolving physical, environmental, and operational risks. With over 75 years of risk engineering expertise and 150 years of customer insights, we deliver tailored solutions that combine technical depth with strategic foresight.

Our Climate Resilience Team, a global network of climate data modelers and climate risk consultants specialize in identifying, assessing, and mitigating climate-related hazards. The team conducts detailed site-level and portfolio-wide analyses based on Zurich-developed climate data.

Their work spans scenario modelling, natural hazard risk assessments, and climate adaptation planning, helping clients navigate regulatory frameworks such as TCFD and CSRD.

The team's approach is both data-driven and pragmatic, offering actionable recommendations that enable businesses to adapt infrastructure, operations, and supply chains to current and future climate risks. With expertise in climate adaptation, mitigation, and sustainability reporting, we empower organizations to not only understand their exposure but to actively manage and reduce it, ensuring resilience in a rapidly changing world.

"Leveraging our expert data analysis offers a robust foundation for understanding climate hazards facing Southeast Asia's major sea cities

- Singapore, Jakarta, Manila, Bangkok, Ho Chi Minh City, and Kuala Lumpur."

Find out more about our services:

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