Built for Insurers but Sold to Investors:

How physical risk methods need a different approach for investors

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Here's the uncomfortable truth: the physical climate risk tools investors rely on today were never designed for investment decisions. They were built for property insurers deciding whether to write a policy on a specific building, not for portfolio managers trying to understand enterprise value impacts.

This creates a systematic blind spot that affects everyone from pension funds to sovereign wealth funds making climate-related investment decisions. The models tell us what it might cost to repair a factory after a hurricane, but they miss the supply chain disruptions, business interruptions, and market ripple effects that often dwarf the initial property damage.

So what's the state of physical climate risk measurement? And are there better approaches emerging that capture what investors actually need to know?

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The Tools Everyone Uses

How physical risk gets measured today

Walk into any major investment firm and you'll find climate risk assessments powered by the same handful of incumbent providers: MSCI, ISS, XDI, and various central bank scenarios. These tools dominate the market despite fundamental limitations that trace back to their insurance industry origins.

MSCI's Climate Value-at-Risk represents the current gold standard. Their high level methodology follows established catastrophe modeling principles, analyzing ten major physical hazards from extreme temperature to tropical cyclones. Their hybrid approach combines top-down climate scenarios with bottom-up asset analysis, based on varying resolutions for temperature analysis.

The core mathematical framework remains consistent across providers: expected cost equals vulnerability multiplied by hazard intensity and exposure value. This formula, borrowed directly from property insurance, works by establishing damage functions that relate physical conditions to financial losses.

Consider how this plays out in practice. For a manufacturing facility facing hurricane winds, the model would assess construction type, building age, local codes, and geographic factors to calculate a "mean damage ratio" - the expected repair cost as a percentage of replacement value. A wood-frame building experiencing 115 mph winds might yield a damage ratio of 35%, translating to $105,000 in expected losses for a $300,000 facility.

This approach works reasonably well for its intended purpose: helping insurers price policies and set reserves. But it captures only direct physical damage, missing the broader business impacts that matter most to investors.

The catastrophe modeling foundation

These methods trace their heritage to catastrophe models developed by companies like AIR Worldwide and RMS for the insurance industry. The technical approach relies on damage functions that exhibit distinct characteristics across hazard types.

Flood damage typically increases rapidly once water depth exceeds one foot, but the rate of increase slows after three to five feet. Wind damage follows a different pattern, accumulating slowly until speeds reach 90-100 mph, then accelerating dramatically. These functions must also account for regional settlement practices, policy coverage types, and socioeconomic factors that influence actual claim payments.

For climate applications, these traditional damage functions get enhanced through scenario integration and temporal modeling. Incumbents combine vulnerability functions with multiple warming scenarios from 1.5°C to 5°C, using both expected value calculations and 95th percentile assessments for extreme outcomes. The final Climate VaR represents the net present value of estimated climate costs through 2100.

The problem isn't that these models are wrong - they're quite sophisticated within their intended scope. The problem is that they're being applied to questions they weren't designed to answer.

But there's an even deeper issue: the climate science foundation itself is fundamentally flawed for the most critical risk types.

The Climate Science Reality Check

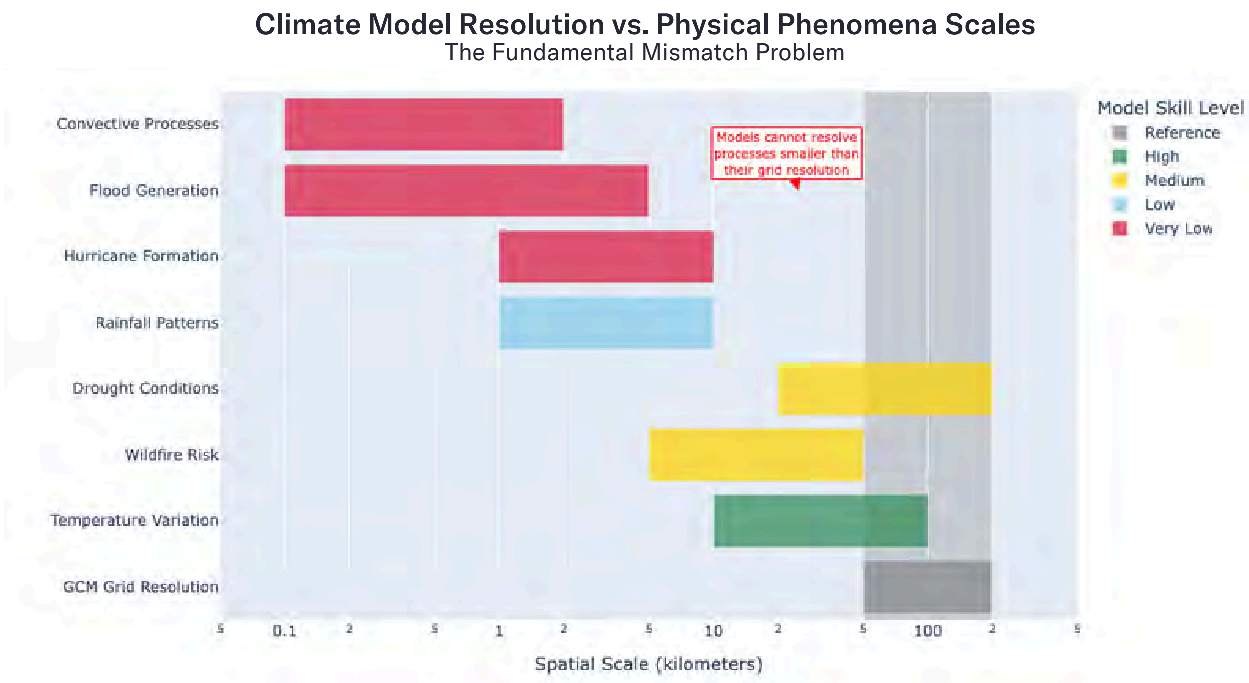
Why the most important risks can't be predicted

Here's what the climate risk industry doesn't want to admit: global climate models fundamentally fail at predicting the very phenomena that drive the largest financial losses - tropical cyclones and floods. The reason is that the models built to predict climate change are not built for small-scale weather.

Global Climate Models (GCMs) operate on grid scales of 50-200 kilometers, but the atmospheric processes that generate hurricanes, rainfall patterns, and flood events occur at sub-grid scales of just a few kilometers or less. It's like trying to predict the behavior of individual waves by looking at satellite photos of entire oceans.

Consider tropical cyclones - responsible for some of the largest insured losses in history. Hurricane formation requires complex interactions between sea surface temperatures, atmospheric instability, wind shear, and moisture patterns that play out over scales much smaller than GCM grid resolution. The models can tell us that ocean temperatures are rising, but they cannot reliably predict where, when, or how intense future hurricanes will be.

The same fundamental limitation applies to precipitation and flooding. Rainfall patterns depend on localized convective processes, topographic effects, and boundary layer dynamics that occur well below the resolution of global models. A GCM might predict regional temperature increases with reasonable confidence, but it cannot tell you whether your specific watershed will experience more frequent flooding.



What works, what doesn't

The cruel irony is that global climate models are good at predicting the climate risks that pose the smallest financial threats. Temperature-dependent phenomena like heat stress, drought conditions, and wildfire risk can be projected with some confidence because temperature changes are relatively smooth and predictable across large spatial scales.

But the highest-impact, highest-cost climate risks - the ones that actually drive investment losses - depend on precipitation and wind patterns that global models simply cannot resolve. This creates a bizarre situation where the climate science is most reliable for the risks that matter least financially, and least reliable for the risks that matter most.

The downstream effects are profound. When incumbent providers project future flood risk using RCP 8.5 scenarios, they're building sophisticated damage functions on top of climate projections that have no skill at predicting flood frequency or intensity. When ISS assesses tropical cyclone risk under different warming scenarios, they're using wind speed projections that global models cannot meaningfully generate.

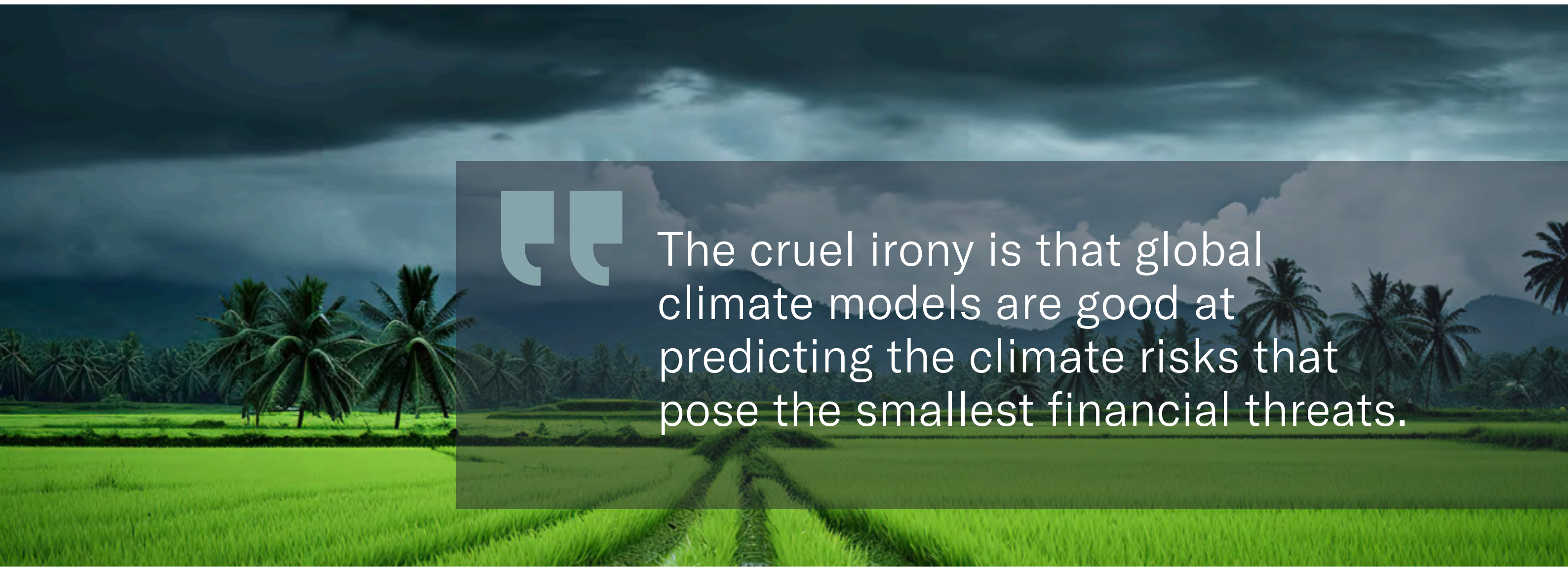
The downscaling deception

The industry's response has been to embrace "downscaling" - statistical techniques that attempt to bridge the gap between coarse global model outputs and fine-scale local phenomena. But downscaling cannot create information that doesn't exist in the original global model runs.

Statistical downscaling typically works by establishing relationships between large-scale climate patterns (which GCMs can simulate) and local weather phenomena (which they cannot). The assumption is that these relationships will hold under future climate conditions - an assumption with no physical basis.

Dynamic downscaling uses high-resolution regional models nested within global models, but this approach faces the same fundamental problem: if the global model cannot simulate the patterns that drive regional weather correctly, running a high-resolution regional model won't help.

The result is an elaborate technical apparatus that creates the illusion of precision while adding no real predictive skill for the phenomena that matter most to investors.



The cruel irony is that global climate models are good at predicting the climate risks that pose the smallest financial threats.

The Blind Spot Problem for Investors

This climate science limitation compounds the business impact problem, while the diversification makes traditional models largely irrelevant for investment decisions. Not only do traditional models miss the supply chain and business interruption effects that dominate total losses, but they provide asset-level precision that doesn't matter to diversified investors while missing the systematic risks that do matter.

What traditional models miss

The gap between what models measure and what investors need becomes starkly apparent when examining real-world climate events. Consider Hurricane Sandy in 2012. While the storm generated dramatic headlines for flooding Manhattan and caused substantial direct property damage, its most significant economic impact came through supply chain disruptions that traditional models completely missed.

Traditional catastrophe models would have captured the direct facility damage from Sandy's flooding and wind. But they would have missed the cascading supply chain disruptions that rippled across multiple sectors nationwide[1]. When the storm shut down major ports, refineries, and transportation networks along the Eastern seaboard, companies across the country faced production delays and inventory shortages that lasted for months. The indirect impacts often exceeded direct property damage by orders of magnitude.

The same pattern emerges across climate events. When Hurricane Harvey flooded Houston in 2017, many companies experienced their largest losses not from direct property damage but from supply chain interruptions as the region's massive petrochemical complex went offline, disrupting more than one-third of US chemical production[2]. These "contingent business interruption" losses often dwarf the initial physical damage but remain invisible to traditional risk models.

Beyond supply constraints, climate change systematically destroys demand across entire sectors. Tourism destinations see booking cancellations that persist for seasons after individual storms, while perception of increased climate risk drives permanent shifts in consumer behavior that exceed any direct weather damage. Traditional models measure what storms destroy, not what they prevent from being built, bought, or visited in the first place.

[1] https://www.reuters.com/article/world/uk/six-months-after-sandy-new-york-fuel-supply-chain-still-vulnerable-idUSBRE93T0DJ/
[2] https://www.bloomberg.com/news/articles/2017-08-28/harvey-disrupts-more-than-one-third-of-u-s-chemical-production

The enterprise value disconnect

The magnitude of this disconnect becomes clear when examining what drives enterprise value during climate events. Direct property damage often represents the smallest component of total impact. Business continuity costs, supply chain disruptions, market share losses, and competitive positioning changes typically dominate the financial outcome.

A hurricane might cause $5 million in direct facility damage but generate $30 million in total enterprise impact through business interruption ($8 million), supply chain disruption ($12 million), market share loss ($3 million), and emergency response costs ($2 million). Traditional Climate VaR would capture only the initial $5 million - and even that level of precision is irrelevant for a diversified company where individual facility losses barely register unless they trigger systematic effects.

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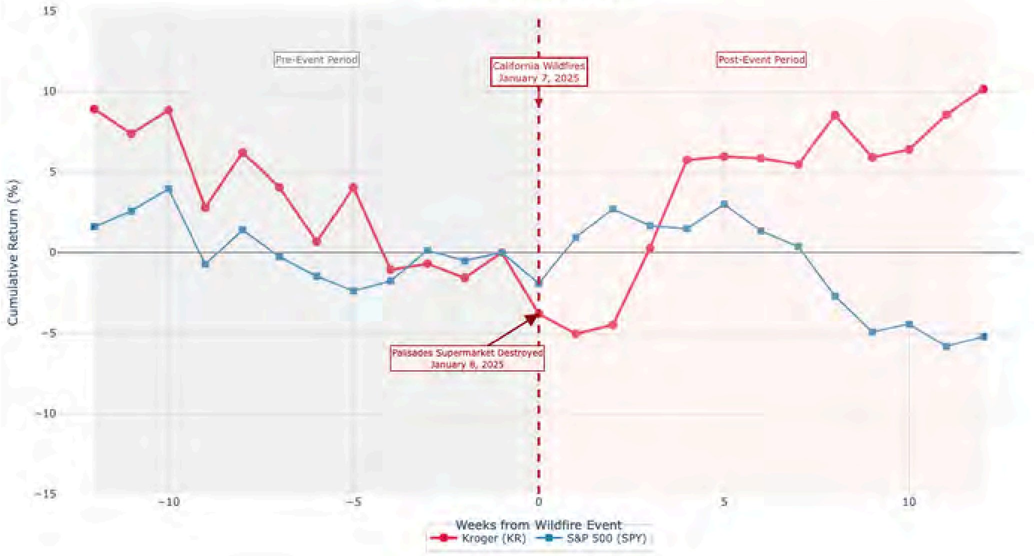
Kroger Grocery California Wildfires Example

Image source: https://join.locally.com/blog/kroger-joins-locally

When catastrophic wildfires swept through California in January 2025, destroying homes and businesses across multiple counties, they created an ideal natural experiment for testing different approaches to climate risk assessment. When the Palisades fire completely destroyed a large Kroger supermarket on January 8[1], traditional catastrophe models would have calculated precise facility replacement costs and flagged this as a significant climate impact.

The market told a completely different story.

Kroger (KR) Stock Response to California Wildfires
Weekly Cumulative Returns vs. S&P 500



[1] https://progressivegrocer.com/la-wildfires-destroy-damage-grocery-stores

Three phases of market response

Weeks 0-2	Weeks 2-4	Weeks 4-12
Initial Systematic Concern Kroger's stock initially declined 5% alongside the broader market as investors worried about potential systematic effects; supply chain disruptions, smoke damage across multiple stores, or regulatory impacts. Both Kroger and the S&P 500 moved together, treating the wildfire as a potentially systematic risk.	Diversification Recognition The market quickly recognized the fundamental math: one destroyed store out of Kroger's 2,800+ locations represents 0.036% of the company's footprint; essentially a rounding error. Despite the complete facility loss that traditional models would flag as significant, Kroger began decoupling from broader market performance.	Resilience Validation Kroger dramatically outperformed the S&P 500, generating 15+ percentage points of excess returns. While the S&P 500 declined to -6%, Kroger surged to +10%; a 16-point differential that occurred precisely when traditional models would be calculating ongoing negative impacts.

The diversification reality

Traditional models obsess over asset-level precision that provides no insight into diversified enterprise impacts. The destroyed Palisades store represented less than 0.04% of Kroger's stores and roughly 0.03% of annual revenue. The market correctly recognized this as immaterial to enterprise value.

The Scale Effect this reveals a crucial insight that traditional models ignore: climate risk varies dramatically with business scale and diversification. A single store destruction has vastly different implications for:

- Kroger (2,800+ stores): Immaterial impact, market validation of resilience
- Regional grocery chain (50 stores): 2% of footprint, moderate concern
- Local independent grocer (1-3 stores): Potentially catastrophic, existential threat

The smaller and more local the business, the greater the actual climate risk. Traditional models miss this scaling relationship entirely, applying uniform vulnerability assessments regardless of diversification levels.

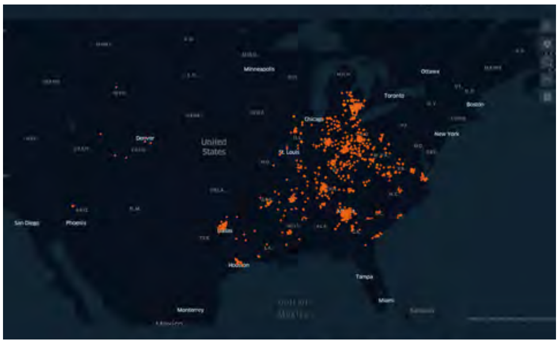


Image source: https://www.xmap.ai/blog/how-many-kroger-stores-are-in-the-united-states-of-america-usa-everything-you-need-to-know

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What this means for investors

The Kroger example demolishes traditional climate risk assessment. While catastrophe models calculated facility-level damages with false precision, the market rewarded demonstrated business model resilience with hundreds of millions in market capitalization gains.

Investors using traditional climate risk tools would have flagged Kroger as wildfire-exposed and potentially underweighted the stock. The actual outcome was the opposite: Kroger's proven resilience during a real climate event validated the investment thesis.

For portfolio management, the lesson is clear - focus on enterprise-wide resilience and systematic effects, not asset-level damage calculations that have no bearing on diversified company performance. The market has already moved beyond insurance-derived models toward approaches that actually matter for investment returns.

> ... the lesson is clear - focus on enterprise-wide resilience and systematic effects ...

Image source: https://progressivegrocer.com/kroger-tests-store-within-store-concept-walgreens

The Business Disruption Illusion

Incumbent methodologies do attempt to go beyond simple asset damage calculations. They often model business interruption alongside physical damage, developing sector-specific vulnerability matrices for a number of different industries and calculating revenue losses from operational disruptions. For acute events like hurricanes, they typically derive downtime duration to things like wind speed and asset type, then calculate the proportion of annual revenue lost during that period.

These approaches appear comprehensive on the surface.

For example, in chronic risk factors like extreme heat, they can count days when conditions exceed specific thresholds and apply sector-specific productivity loss rates. They may even calculate specific, different productivity losses for sectors at certain heat levels. The methodology produces elaborate calculations with apparent precision - estimating costs to multiple decimal places for individual facilities.

But this sophistication masks fundamental gaps that actually validate the core limitations investors face. Even the incumbent business interruption modeling approach reveals the false precision problem when examined closely - particularly given that the underlying climate projections for wind and rainfall patterns remain completely uncertain.

The downtime duration mystery

While incumbents state they estimate "duration of downtime" using "windspeed category and asset type," any further depth of the methodology is unavailable. No specifics are openly available about how hurricane wind speeds translate to recovery timeframes for different facility types.

This opacity becomes even more problematic when we consider that climate models cannot reliably project the wind speeds these calculations depend on. Global climate models fundamentally fail at predicting tropical cyclone intensity and frequency - the very phenomena that would determine whether a facility experiences 100 mph or 120 mph winds. Yet the entire business interruption calculation hinges on precise wind speed projections that climate science cannot provide.

The same limitation applies to flooding, where business interruption depends on rainfall patterns that occur at scales far below what global models can resolve. How long does a manufacturing facility remain offline after experiencing different flood depths? Again, this is not openly available, yet these duration assumptions seemingly drive the entire business interruption calculation based on precipitation projections that have no predictive skill.

The supply chain black hole

Incumbent methodologies openly acknowledge that supply chains are typically non-transparent and complex. This leads to a limit of excluding supply chains from their analysis. This represents a massive blind spot since supply chain disruptions frequently exceed direct damage costs by orders of magnitude. The 2011 Thailand floods caused more total economic damage than Japan's tsunami precisely because of cascading supply chain effects that traditional models miss entirely.

The incumbent asset-level approach calculates interruption at individual facility levels, then aggregates upward. This misses the network effects where disruption at one critical supplier or logistics hub can paralyze entire business operations. A semiconductor fabrication plant in Taiwan might show minimal direct climate risk in traditional models, but its disruption could cascade through global electronics supply chains in ways that dwarf the initial facility damage.

The uncertainty compounds when we consider that supply chain disruptions often result from rainfall and wind patterns that climate models cannot predict. A supplier shutdown triggered by flooding in an unexpected location - based on precipitation patterns that models have no skill at forecasting - can cascade through global networks in ways that no amount of facility-level modeling can anticipate.

Revenue versus enterprise value

The business interruption modeling focuses on short-term revenue disruption - days or weeks of lost output that can be calculated and recovered. But climate events increasingly affect longer-term competitive positioning, market share, customer relationships, and strategic advantage in ways that traditional interruption models cannot capture.

When Hurricane Sandy disrupted financial services in New York, the lasting impact wasn't the week of lost trading revenue but the acceleration of business continuity investments and geographic diversification strategies. Markets priced these strategic implications immediately, while traditional risk models captured only the direct operational losses.

This disconnect becomes more severe when considering that the climate projections underlying these models cannot reliably predict the storm intensities or rainfall patterns that would actually determine business impacts. Models might project business interruption costs based on hurricane scenarios that climate science fundamentally cannot forecast with any precision.

> ... climate events increasingly affect longer-term competitive positioning, market share, customer relationships, and strategic advantage ...

The systematic risk exclusion

Incumbent methodologies also note that they aren’t able to capture opportunities or broader market dynamics where climate events create winners and losers within industries. A drought that affects all agricultural producers doesn't just reduce crop yields uniformly - it reshuffles competitive positions based on water access, storage capacity, hedging strategies, and adaptive capacity that models struggle to quantify.

The incumbent approach assumes climate impacts translate linearly into business costs, missing the threshold effects and competitive dynamics that actually determine enterprise value. A company that maintains operations during a climate event while competitors shut down may gain market share worth far more than the additional operational costs incurred.

But the fundamental problem remains: these calculations depend on precipitation and temperature projections where climate models have vastly different levels of skill. While temperature projections show reasonable confidence, the rainfall patterns that drive droughts and floods - the events that actually create these competitive dynamics - remain essentially unpredictable at the scales that matter for business decisions.

The adaptation measurement problem

While incumbents often include analysis on remediation or risk reduction factors for basic adaptations like air conditioning prevalence, they acknowledge inability to measure company-specific resilience investments, adaptive capacity variations, insurance coverage levels, or management quality in crisis response. These factors increasingly determine which companies thrive versus struggle under climate stress, but they remain invisible to traditional risk models.

This connects directly to why market-based approaches may prove more reliable than model-based assessments. Credit markets and equity valuations incorporate collective intelligence about these unmeasurable resilience factors through price discovery that no amount of facility-level modeling can replicate - especially when the underlying climate projections for the most financially significant risks lack any meaningful predictive skill.

The business interruption modeling represents a significant advance over pure asset-damage approaches, but it remains trapped within the facility-level, direct-impact framework that misses the enterprise-wide resilience factors that actually determine investment outcomes. When even the duration of facility downtime relies on opaque assumptions built on climate projections that cannot predict wind speeds or rainfall patterns with any reliability, the precision of the entire approach becomes questionable.

Market Signals
Tell a Different Story

Market-based evidence of climate risk pricing

While traditional models struggle with comprehensive impact assessment, financial markets have begun developing their own climate risk indicators. Recent academic research has begun addressing this gap by examining actual market responses to extreme weather events. This growing body of literature provides crucial insights into how financial markets process and price physical climate risks.

Kruttli, Roth Tran, and Watugala (2025) provide the most comprehensive analysis to date, examining firm-level exposures to hurricanes from 1996 to 2019. They document that stock options of firms with establishments in hurricane landfall regions exhibit implied volatility increases of 5-10%, with uncertainty persisting for up to three months after landfall. Their analysis reveals that investors systematically underestimated extreme weather uncertainty until Hurricane Sandy in 2012, which served as a learning event that improved subsequent market pricing.

Liu et al. (2024) complement this US-focused analysis with a comprehensive study of the NASDAQ 100, employing event study methodology on 526 climate disasters from 2000-2019. They find heterogeneous impacts across disaster types: biological and hydrological events have significantly negative impacts on stock returns, while climatic events paradoxically show positive impacts. This heterogeneity underscores the complexity of market responses to different types of extreme weather events.

Additional studies reveal substantial variation in how different industries respond to extreme weather events. Kumar, Xin, and Zhang (2019) develop firm-level temperature sensitivity measures, documenting significant overpricing in stocks with high temperature sensitivity and showing that institutional investors systematically underweight climate-sensitive firms. Hong, Li, and Xu (2019) provide foundational evidence of market inefficiency in pricing climate risks, demonstrating that markets consistently underprice drought risk in food company stocks. Despite these advances, markets continue to struggle with efficiently processing climate information, creating both opportunities and inefficiencies.

These market-based approaches leverage collective intelligence to provide forward-looking risk signals that are often better suited for investors than model-based assessments.

Why equity markets see what models miss

Stock market-based approaches offer several advantages over traditional catastrophe modeling for investment applications. They naturally incorporate the diversification reality that individual asset losses rarely drive investment returns unless they trigger systematic effects. Stock prices reflect market assessments of enterprise-wide resilience rather than facility-level vulnerability.

More importantly, equity valuations capture comprehensive risk impacts through forward-looking price discovery that reflects collective market intelligence about systematic effects rather than isolated asset damage. When markets price climate risk into stock valuations, they're incorporating supply chain vulnerabilities, competitive positioning, regulatory exposure, and adaptive capacity - factors that matter for diversified enterprises but don't show up in asset-level damage calculations.

Stock prices reflect market expectations of business disruption across multiple time horizons, incorporating both immediate operational impacts and longer-term strategic implications. Option pricing reveals market uncertainty about future climate impacts, with implied volatility spikes indicating when investors perceive elevated risk from extreme weather events.

Perhaps most importantly, equity markets naturally incorporate network effects and contagion that traditional models miss. Supply chain interdependencies, sector-wide impacts, and macroeconomic effects all influence stock pricing but remain invisible to traditional risk models. When a climate event affects one company, market participants immediately assess implications for competitors, suppliers, and related industries.

The validation function of market signals proves particularly valuable given the fundamental limitations of climate projections. When climate models cannot reliably predict future hurricane or flood patterns, equity market responses that reflect actual business impacts and adaptation dynamics become even more important for investment decisions.

... equity valuations capture comprehensive risk impacts through forward-looking price discovery that reflects collective market intelligence about systematic effects rather than isolated asset damage.

The learning curve in climate risk pricing

The research reveals that markets are continuously learning how to price climate risks more effectively. The Hurricane Sandy watershed moment documented by Kruttli, Roth Tran, and Watugala demonstrates how major climate events serve as learning experiences that improve subsequent market pricing. Before Sandy, investors systematically underestimated extreme weather uncertainty. After Sandy, option markets began pricing hurricane risk more appropriately.

This learning dynamic suggests that equity markets are developing increasingly sophisticated approaches to climate risk assessment. As more extreme weather events occur and more research documents their impacts, market participants gain better insights into which companies and sectors are most vulnerable to climate disruption.

The heterogeneous responses documented across different disaster types also indicate that markets are learning to distinguish between various climate risks rather than treating all extreme weather events uniformly. This nuanced approach contrasts sharply with traditional models that often apply standardized damage functions across diverse climate phenomena.

The false precision problem

The climate science limitations create a particular challenge for the risk modeling industry: how do you acknowledge fundamental uncertainty while still providing the quantitative outputs that clients demand?

The answer, unfortunately, has been to embrace false precision. Climate risk models routinely report results to multiple decimal places based on climate projections that have no meaningful skill for the underlying physical processes. This creates dangerous overconfidence in both the models and their users.

A more honest approach would acknowledge that we cannot predict future tropical cyclone activity or regional precipitation patterns with any meaningful precision. The models could still provide value by identifying areas of potential exposure and testing sensitivity to different assumptions, but they should not be presented as predictive tools for phenomena they cannot predict.

Testing the Approaches

A real-world comparison

To understand these differences practically, consider how different approaches would assess climate risk for a major automotive manufacturer with global supply chains.

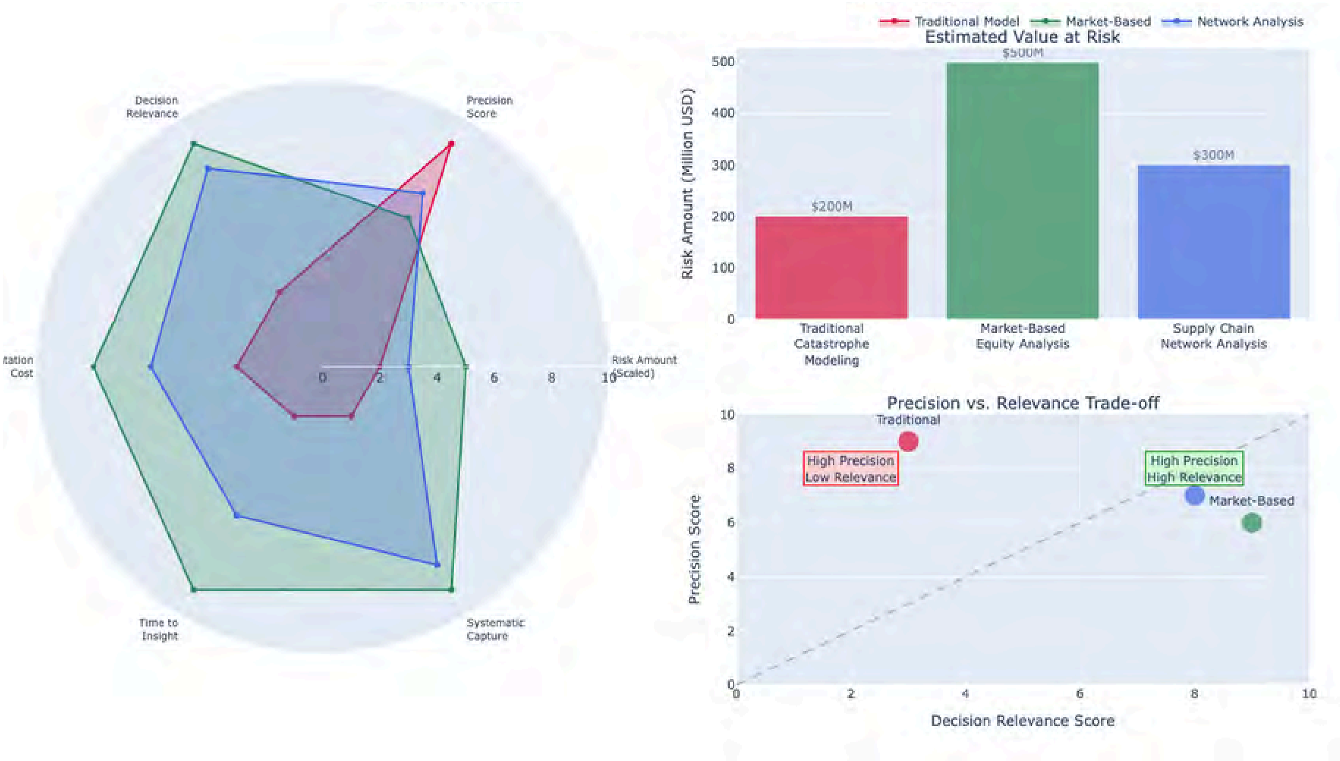
Traditional catastrophe modeling approach:
The analysis would map production facilities, assess local climate hazards using global climate model projections, and calculate expected physical damage costs with asset-level precision. The model might identify seventeen facilities at risk from various climate hazards and estimate total potential damage of $200 million across all locations. But for a diversified manufacturer with hundreds of facilities, these individual asset losses wouldn't meaningfully impact enterprise value unless they triggered systematic effects.

Equity market-based validation:
Stock price movements and option volatility for the same company reflect market participants' collective assessment of enterprise-wide climate resilience rather than facility-level vulnerability. These market signals incorporate supply chain concentration risks, adaptive capacity, competitive positioning, and systematic exposures that matter for investment returns. During climate events, stock price reactions might indicate $500 million in potential value at risk - not from direct asset damage but from systematic disruptions that could affect the entire business model.

Sector comparison analysis:
Examining how the company's stock performs relative to industry peers during climate events reveals market perceptions of relative resilience. Companies with superior supply chain diversification, adaptive capacity, or operational flexibility typically see smaller stock price declines during extreme weather events, indicating market recognition of these unmeasurable resilience factors.

The equity market-based approach proves more reliable because it reflects the diversification reality of modern enterprises and focuses on systematic effects that actually drive investment returns. Rather than obsessing over precise asset-level damage calculations that get absorbed by diversified operations, markets price the enterprise-wide resilience factors that determine long-term competitive position and financial performance.

Climate Risk Assessment Approaches: Automotive Manufacturer Example
Comprehensive Comparison of Methods



The hybrid solution

Leading organizations increasingly recognize that neither approach alone provides complete insight, and that traditional climate projections lack the precision needed for detailed risk quantification. The optimal solution combines observable trend analysis with equity market-based validation and sector comparison analysis for comprehensive impact evaluation.

Physical risk models remain valuable for understanding relative hazard exposures and testing sensitivity to different assumptions. But they should not be treated as predictive tools for phenomena that cannot be predicted. Instead, their outputs require substantial uncertainty bounds and validation through market-based approaches that reflect real-world adaptation dynamics and business impacts.

The regulatory environment supports this evolution. Central banks increasingly require stress testing that extends beyond direct physical impacts to include supply chain, network, and systemic effects. However, these stress tests should incorporate market-based validation mechanisms rather than relying solely on model outputs with questionable predictive skill.

The Investment Implications

What this means for portfolio management

The methodological limitations identified have profound implications for investment strategy and risk management. Portfolio construction based solely on traditional Climate VaR metrics may systematically misprice climate risks, particularly for companies with complex supply chains or significant business interruption vulnerability.

The problem extends beyond individual security selection to fundamental questions about sector allocation, geographic diversification, and risk budgeting. When traditional models suggest manageable physical risks while equity market indicators signal substantial concern, investors face difficult decisions about which signals to trust.

The evidence increasingly favors equity market-based approaches for investment decisions. Stock price analysis during climate events, option volatility assessment, and sector rotation patterns offer real-time risk indicators that complement scenario-based modeling. These signals prove particularly valuable for identifying emerging risks and validating model predictions against market expectations.

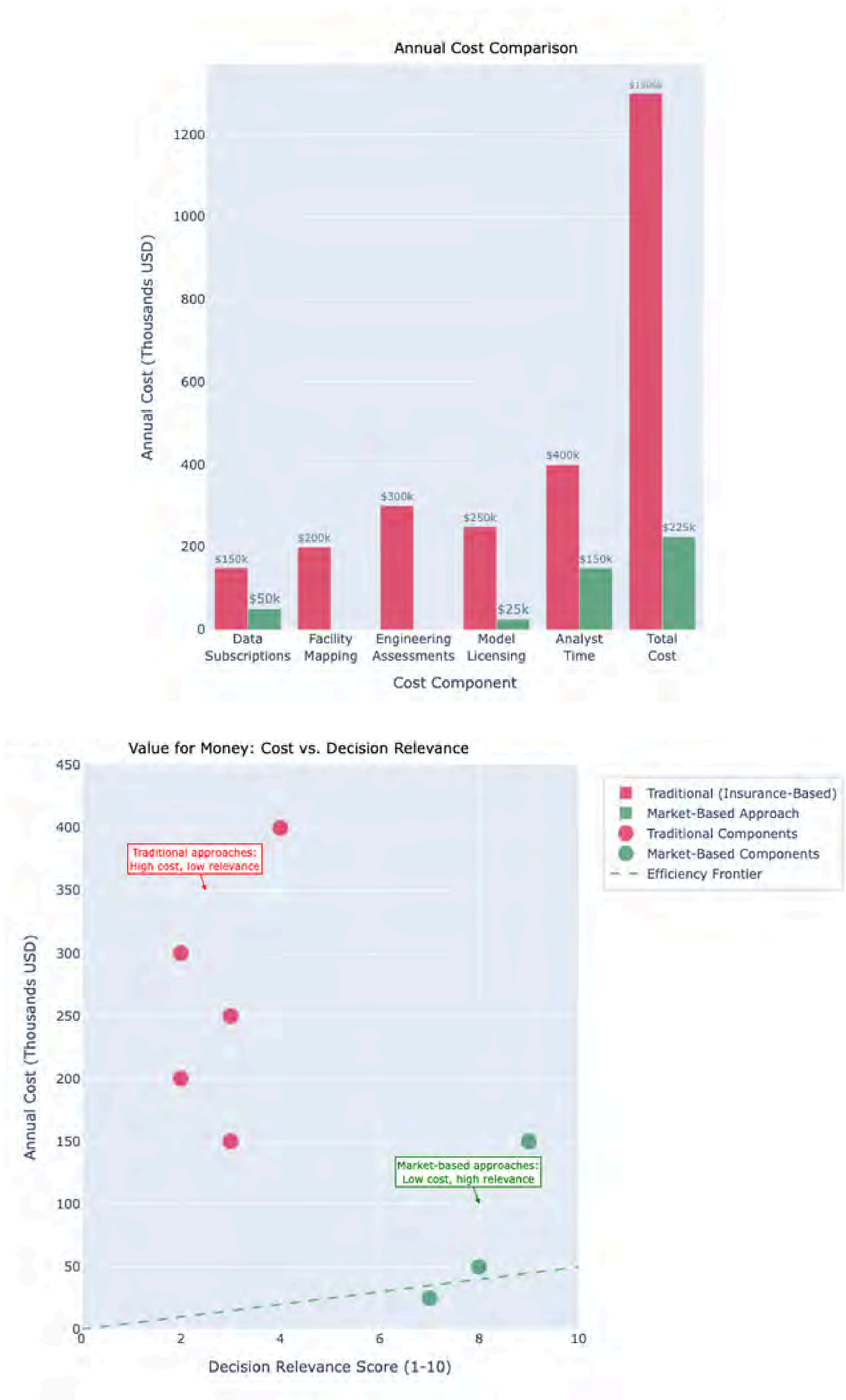
The cost of misaligned tools

A critical but overlooked issue is that investors are paying premium prices for granular asset-level climate risk assessments designed for insurance underwriting, not investment decision-making. Incumbent VaR methodologies often calculate precise damage ratios for individual facilities, estimating facility-specific downtime durations, and provide building-level vulnerability assessments across thousands of company locations worldwide.

This granular precision commands substantial fees from investment clients despite being largely irrelevant for diversified portfolio management. A pension fund doesn't need to know the wind damage vulnerability of a specific Toyota manufacturing plant in Thailand - they need to understand Toyota's enterprise-wide resilience compared to Honda, Volkswagen, and other automotive competitors.

The mismatch creates a peculiar situation where investors subsidize the development of insurance-focused analytics that don't address their core needs. Investment managers pay for 90-meter flood resolution mapping when they actually need systematic risk indicators. They purchase facility-level hurricane damage calculations when they require sector rotation signals and competitive positioning analysis.

Climate Risk Analytics: Cost vs. Value Analysis
Investors Pay Premium for Insurance-Focused Tools



What investors actually pay for vs. what they need

What they pay for	What they need
Precise damage ratios for individual buildings and facilities	Enterprise-wide resilience comparisons across competitors
Facility-specific downtime duration estimates based on wind speeds	Supply chain network vulnerability and adaptive capacity indicators
Asset-level flood depth damage functions	Market-based validation of systematic climate exposures
88-sector vulnerability matrices for business interruption	Real-time equity market signals during actual climate events

This cost structure reflects the climate risk industry's insurance origins rather than investment market needs. Providers charge premium rates for granular physical assessments while the systematic risk indicators that actually drive investment returns remain underdeveloped or missing entirely.

The financial implications extend beyond direct subscription costs. Investment teams spend significant resources interpreting and aggregating facility-level outputs that provide minimal decision-relevant insights. Analyst time gets consumed translating insurance-oriented metrics into investment-relevant frameworks, creating additional hidden costs for precision that doesn't improve investment outcomes

> This (incumbent) cost structure reflects the climate risk industry's insurance origins rather than investment market needs.

Looking Forward

The path to better climate risk assessment for investors

The future of investment-focused climate risk measurement requires a fundamental reorientation away from insurance-derived tools toward approaches designed specifically for portfolio management needs. Investors need a clear path to escape the current trap of paying premium prices for increasingly granular precision they don't need, replacing it with the systematic risk indicators that actually drive investment returns.

1. **Recognize the tool mismatch**

   The first step for investors is acknowledging that current climate risk tools were never designed for their use case. Incumbent's facility-level damage calculations, asset-specific vulnerability assessments, and building-by-building flood mapping serve insurance underwriting needs, not investment decision-making. Investors should audit their current climate risk spending to understand how much they're paying for insurance-focused granularity versus investment-relevant insights.

2. **Prioritize systematic over asset-level risk**

   Investors should redirect analytical resources toward systematic risk indicators that actually influence portfolio performance. This means focusing on enterprise-wide resilience comparisons, sector rotation patterns during climate events, supply chain network vulnerabilities, and competitive positioning analysis rather than individual facility damage estimates.

3. **Leverage market-based validation**

   Rather than relying solely on theoretical model outputs with questionable predictive skill, investors should incorporate market-based approaches that reflect actual business impacts. Stock price analysis during climate events, option volatility patterns, and equity correlation changes provide real-time validation of climate risk exposures based on demonstrated market responses rather than engineering calculations.

4. **Build investment-native analytics**

   The most sophisticated investors are developing internal capabilities that leverage existing market data infrastructure rather than purchasing expensive facility-level databases. Event study methodologies, performance attribution analysis during climate stress periods, and sector rotation modeling can often provide superior investment insights at lower cost than traditional catastrophe modeling approaches.

Emmi's Physical Risk analysis can help you achieve many of these steps.

The competitive advantage for early adopters

Investors who make this transition early will gain significant competitive advantages. They'll achieve better climate risk insights at lower analytical costs while competitors continue overpaying for misaligned tools. They'll develop investment processes based on market-validated approaches rather than theoretical model outputs with limited predictive skill.

Most importantly, they'll build analytical capabilities that improve rather than complicate investment decision-making. Instead of consuming analyst time translating insurance-oriented metrics into investment frameworks, they'll deploy market-based approaches that directly inform portfolio construction, sector allocation, and risk management decisions.

The economic logic

The economic case for this transition is compelling. Market-based approaches often leverage existing data infrastructure and analytical capabilities rather than requiring expensive specialized subscriptions. Event study analysis uses standard financial databases. Option volatility monitoring employs existing derivatives market data. Sector rotation analysis builds on established performance attribution frameworks.

This cost efficiency matters increasingly as investment organizations face pressure to demonstrate clear ROI from climate risk analytics spending. Tools that improve actual investment outcomes while reducing analytical costs will inevitably gain market share over expensive legacy approaches that provide impressive technical detail but limited decision-making value.

The inevitable shift

The shift toward investment-focused climate risk analytics is inevitable. As more research documents the limitations of traditional catastrophe modeling for investment applications, and as market-based approaches demonstrate superior practical value, investors will demand tools designed for their specific needs rather than insurance industry hand-me-downs.

The question for individual investors isn't whether this transition will happen - it's whether they'll lead the change and capture competitive advantages, or wait for the industry to evolve around them while continuing to pay premium prices for diminishing analytical value.

The path forward is clear: recognize the current tool mismatch, prioritize systematic over asset-level risk indicators, leverage market-based validation approaches, and build investment-native analytics that directly support portfolio decision-making. The investors who follow this path will achieve superior climate risk management at lower cost while developing sustainable competitive advantages in an increasingly climate-conscious investment landscape.

About Emmi

Emmi is ‘your net-zero investor toolkit’ – we provide financed emissions data and climate risk analysis across all major public and private asset classes. These support climate-related reporting, and analysis that feeds into investment management processes.

Emmi is partnered with FactSet to provide a comprehensive climate risk analysis product for institutional investors. We cover public equities, public fixed income, private equities, private fixed income, property and infrastructure. Our Physical Climate Risk methodologies have been built from the ground up for investors, with the market level information and context required to support real, risk-based investment decisions.

EMMI

For more information

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