Community Finance Brief

A Civic Foundry: Building a Collaborative Future for Climate-Ready Communities

MATT POSNER | COURT STREET GROUP

Climate change has disrupted the way many communities function and most adults see mounting risks around the world. It has broken the insurance profitability model, the infrastructure within which essential services are provided is tenuous and our governments are losing billions every year with a patchwork process of short-term mitigation plans, marginal preparedness operations and expensive response and recovery programs. A new group of U.S. governments, insurers, mathematicians and climate scientists have built a system to help.

Natural disasters are coming with more frequency and with more tenacity than ever before and the costs to governments and the communities they support are growing. We mitigate through urban planning, we prepare by developing emergency response plans and stocking supplies, and we respond to emergencies with most support coming from the federal- and state-level. *The cost of this approach is untenable*.

Inspired in part by a convening with Pew Charitable Trusts, earlier this month, the largest government finance network in North America and one of the largest global insurance solutions providers **proposed the formation of a consortium** to establish standards for communicating and analyzing climate risk uncertainty for a new collaborative approach to simulation. In a new report, they outline a new and functioning chance-informed decision-making model that city managers can use.

The Government Finance Officers Association (GFOA) is a membership association representing 23,000 public finance officers in North America and is the heavyweight when it comes to best practices, shared ideas and policy advocacy

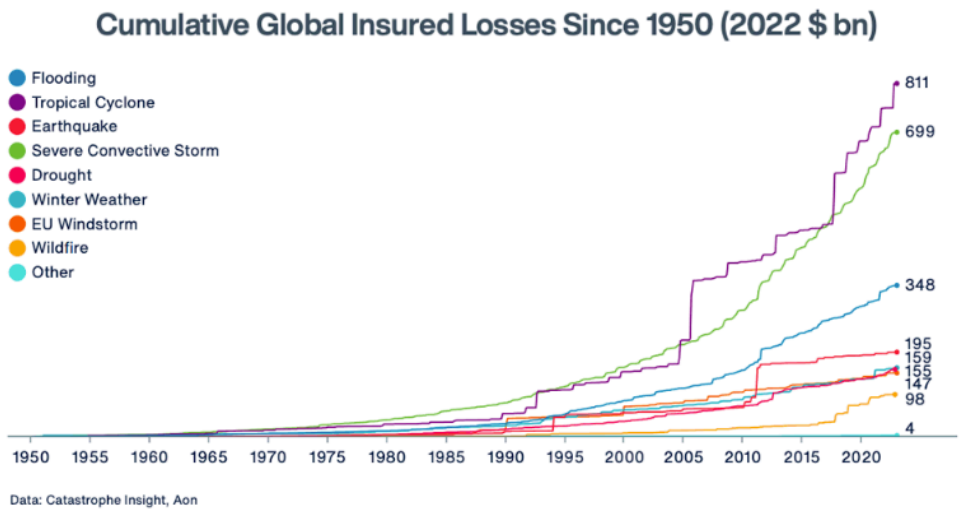
Quick Takes

Between 2012 and 2023, 88.5% of all U.S. counties declared a natural disaster, including 95% of the most populated counties.
– *Forbes Advisor*

All 50 U.S.states saw year-over-year property insurance premium increases in 2023 with 15 states seeing double-digit increases
– *S&P Global Market Intelligence*

Annual costs of damages caused by natural disasters have exceeded $100 billion in five of the last six years (2017-2022), surpassing the 43-year inflation-adjusted annual average cost by nearly threefold
– *National Centers for Environmental Information*

Monte Carlo simulations can be used to estimate the probability of events happening in the real world, such as a financial crisis or a natural disaster. Its namesake comes from where the game of roulette was invented. Oppenheimer's team used it extensively in testing during the Manhattan Project.



as it pertains to various topics wherein local governments have a footprint.

In 2013 the GFOA teamed up with non-profit Probability Management, which develops tools and open standards for chance-informed decision making in order to help government finance officials better communicate uncertainty and risk.

Meantime, Aon is one of the world's largest insurance brokers and risk management firms. As an active investor in research and development in insurance and risk management, when they announced a partnership with the GFOA last year there were many market participants curious to see what the result would be.

These organizations have made a call to action that has the potential to be an influential tool moving forward for state and local governments. This consortium could be part of a future where climate volatility is properly assessed and our communities are better prepared.

A CALL TO ACTION: A CONSORTIUM

"We intend to form a consortium of climate scientists, insurance service providers, policy makers, financial managers, and others to establish standards for communicating the uncertainty of climate risk. The goal is to create a collaborative network that explicitly communicates the chances of adverse events, not just average impact. Furthermore, it is required that such information be accessible by local decision makers without statistical training for use in their own chance-informed calculations." - Chances: Conveying Hazards and Natural Catastrophes through Extracted Simulations.

The GFOA, Aon and Probability Management are asking stakeholders to participate in the process of creating standards within which governments can start to leverage the models that have been built and for their advice on where this process should be headed. Between these three organizations, the potential network of collaborators is vast. And it should be, in order to get real buy-in and get a critical mass of local government support, it will require leaders in many industries.

As it now stands, the initiative has the ability to model out various types of natural disasters and review their potential impacts on local budgets but its open-sourced approach will allow for any number of avenues to head down next. Essentially, any community should be able to eventually look at a multitude of outcomes impacting various parts of a local government's operations. While the financial ramifications are key, the providing of essential services and environmental aspects of this type of modeling has real potential as well.

Taking it a step further, these groups would benefit from structuring their initiative in the form of **an incubator lab**. Long has GovTech and FinTech operated on multiple, different levels. State and local governments look for technical solutions separately while many of their problems are the same. GFOA's membership would benefit from having a landing space for GovTech and FinTech leaders to scope out needs and offer solutions in a space for GFOA membership. Through this lab, governments could collectively own their own solutions and technologists and financiers would be able to test ideas and scale more easily through the network of government finance officers.

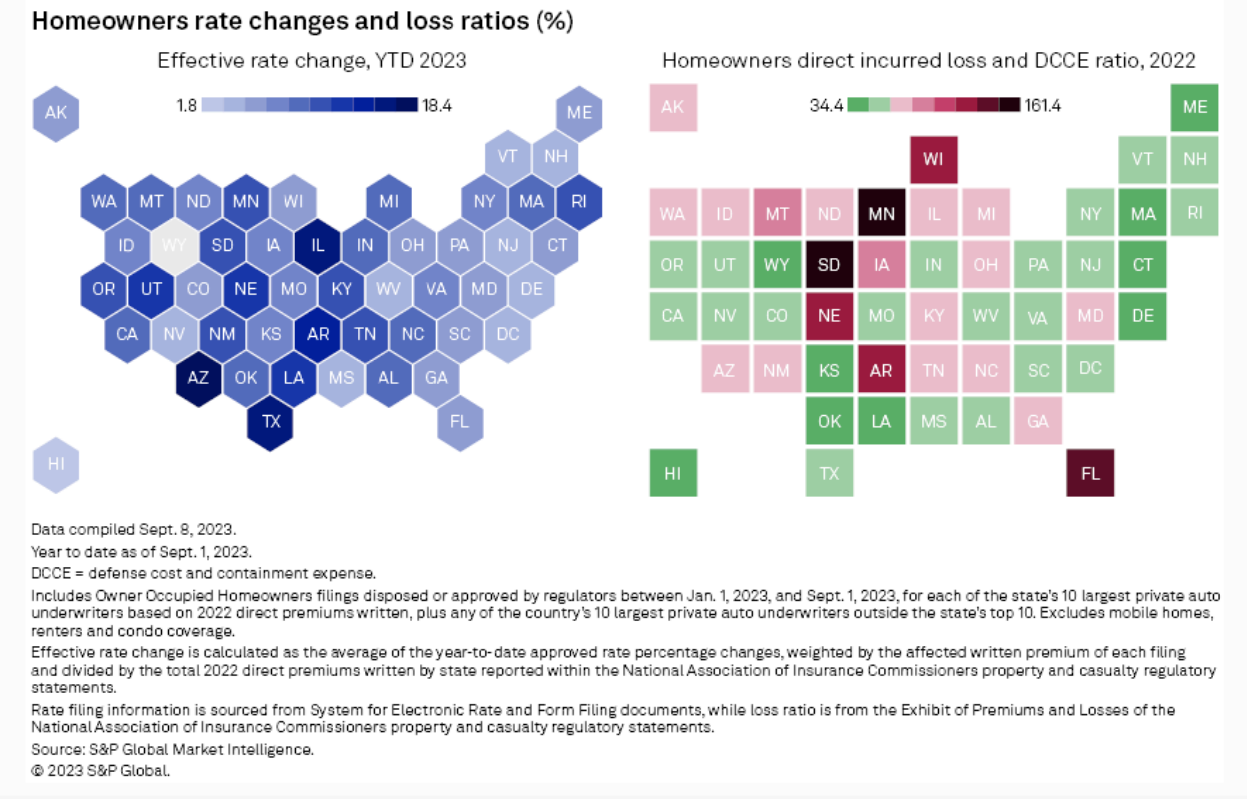
CLIMATE VOLATILITY, INSURANCE AND GOVERNMENT

Connecting the dots between more natural disasters and the negative impact on communities and their governments is clear. The most effective prism in which to analyze how these disasters effect government decision-makers is to better understand what is happening with the property insurance industry. Virtually every transaction in this country is backed by some sort of insurance. The transfer and mitigation of risk through insurance and reinsurance impacts every facet of daily life (see quote, **right**).

> "When structured as an appropriate risk transfer mechanism [property and casualty] insurance can encourage pre-disaster mitigation efforts through lower premiums for more resilient properties, as well as signal areas at greater risk through appropriate premium increases," states the **National Climate Resilience Framework**, Sept. 2023. "However, as climate change increases the frequency of catastrophic, very high-loss events, [property and casualty] insurance and reinsurance are becoming increasingly unattainable and unaffordable."

The increased cost of insurance policies, less active insurers, the role of the federal government, politics and lapses in actuarial modeling and what that means for government budgets, ability to provide essential services, and creditworthiness are all variables that are negatively affecting local government more than ever before.

As **CSG** covered in October of 2023, at least 20 property insurance companies have announced changes to their coverage as a result of increased natural disaster and/or climate change in the last year. Companies are either declining to write new policies or are increasing the cost of insurance as actuarial modeling is reflecting climate volatility more accurately (or its unpredictability more accurately). Between May of 2022 and May of 2023 the average home insurance premium at renewal increased on average of 21% nationwide, per Policygenius.



The broad swath of impacts of these changes include:

- State-sponsored plans see an increase of usage, which is a state budgetary constraint;
- The difficulty for insurers in pricing climate risk appropriately has made for broad questioning to the accuracy of property value and taxes, that, all else being equal, will decline for areas where property insurance premiums are increasing and negatively impacting local government budgets;
- Migration trends will start to reflect people moving away from areas prone to natural disasters once isolated for the pandemic period;
- Rating agencies link the availability of property and casualty insurance in a community to the bond rating of said government (fewer options has negative rating implications);
- Disaster relief becomes much more expensive for governments as insurance coverage declines; and
- Low-income and under-served populations are affected at a much higher level than other parts of the population.

These variables make local government decision-making regarding climate change all the more important. As the frequency of these events increase, and the widely recognized poor use of data by the federal government (here is one report of many by the U.S. Government Accountability Office), local governments are left with few tools at their disposal to predict, assess, model and communicate climate risk to their constituents.

'FLAW OF AVERAGES'

The principal thesis behind much of their stated intensions is predicated on probability management that adheres to both the principals of mathematics and probability, while maintaining statistical coherence. This allows one to quantify uncertainty by playing out every imaginable scenario within parameters of ones choosing and layering in economic damage and financial losses within those scenarios. The business of climate risk is better understanding uncertainties. These models dive head first into this.

The report argues that current methods, which rely on averages, misrepresent risk and lead to flawed decision-making. The 'flaw of averages' represents risk as a single number and this ignores crucial information about potential outcomes. Averages are summary statistics that obscure variations. Risk is derived from variation. Relying on summary statistics can lead to an underestimating of risk or making poor decision based on inaccurate data.

To add context, the Federal Emergency Management Agency tracks property damage post-event that has been declared a national emergency. Hurricane Sandy in 2012 had an average of $11,000 worth of damage, this might make one assume about half the households were greater and half were less. *But hazard outcomes are highly asymmetric,* and as such, the reality is that most homes would see minimal damages while roughly 5% of these households saw damages of $40,000 or more. Proponents of this simulation's argument is that the $11,000 figure is not very helpful. This model aims to move past the average and look at probabilities to help city managers and others better navigate risk.

Their solution relies on Stochastic Information Packets (SIPs), which contain thousands of possible outcomes from climate simulations. This allows decision-makers to see the full range of possibilities and are informed choices (see box**, page 6,** for details on SIPs). Essentially, using Aon's data on natural disasters, Probability Management's ability to simulate tens of thousands of scenarios, and the GFOA analysis of community budgets - this group has created a way to assess not just the probability of something happening (an average) but to provide a more complete picture of risk and enable modular simulations by separating hazard and asset models that produce actionable results.

They propose a networked approach, which is essentially an open-sourced consortium wherein various providers can share SIPs that cover a broad range of inputs so as to create a more holistic approach to risk factors that could impact a government. The consortium would provide a structure within which data points are input and simulations are run and the intent is that the end platform is easily accessible to people of any form of statistical and data understanding.

HOW IT WORKS

To help fill in the picture, we can point to work GFOA did with Aon in 2021 with the city of Providence, Rhode Island. You can review part of a GFOA simulation by clicking here or read about the work with the city here.

Using the probability management approach with Aon's climate data, the GFOA modeled out what the city needs in terms of reserve fund levels taking into account not only natural disaster risks, but also various impacts of economic downturns and a pandemic. So, any city official can pull open an excel spreadsheet, and run any number of simulations to have a more holistic review of what the city needs over the next decade.

Specifically, the model identified six major natural disaster risks that are relevant to the city and various types of economic downturns, analyzed historical data and other municipalities, gathered insights from city staff and reviewed its hazard mitigation plan and developed a 10-year probabilistic model to estimate the necessary reserve level that provides sufficient confidence in covering potential losses from analyzed risks.

The principal challenge here was to balance the need for financial flexility through its reserves and the efficient use of public funds to find a suitable level to protect the community from vulnerability to economic downturn and natural disaster. The analysis also focused on risk retention and mitigation strategies such as parametric insurance and issuing debt.

The GFOA and its partners then built a model that considers the City's risks over a ten-year time horizon. The GFOA risk model runs "hundreds, thousands, or even ten thousand simulations" of possible futures for Providence. Aside from the climate data provided by Aon that predicts impacts of millions of scenarios as it pertains to climate, the model also makes fundamental financial inquiries as far as property taxes, other local taxes, state aid and

Stochastic Information Packets (SIPs): Unpacking Uncertainty in Risk Management

SIPs are a unique data structure used in **probability management** to represent the variability and uncertainty associated with real-world phenomena. Think of them as tiny pockets of information that capture the full range of possible outcomes for a specific variable, rather than just relying on an average or single-point estimate.

What they hold:

- **Multiple values:** Instead of a single number, SIPs contain thousands or even millions of possible values for a particular variable, like future stock prices, rainfall amounts, or insurance claims. These values may be generated through simulations, historical data, or expert opinions.
- **Metadata:** Each SIP also includes additional information about the data, such as the statistical distribution of the values, any relationships with other variables, and the methods used to generate them.

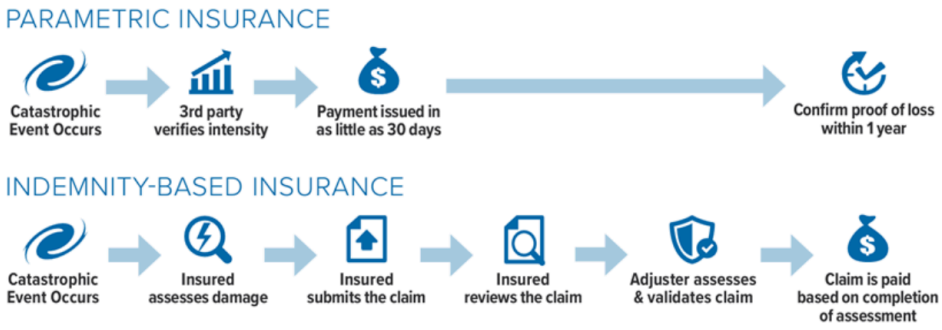
Their purpose:

- **Improved decision-making:** By providing a more comprehensive picture of potential outcomes, SIPs help decision-makers avoid the "flaw of averages" and make more informed choices, especially in situations with high uncertainty.
- **Modular simulations:** SIPs separate hazard and asset models, allowing for easier and more scalable simulations across different scenarios.
- **Actionable results:** The results are presented in a format that can be readily understood and used in various software platforms, making them directly applicable to decision-making processes.

compares it to Charlestown (a similar municipality). Some of these assumptions are user-definable so that the City can explore alternative scenarios to those described in the report.

The findings are detailed and breaks down all the various inputs over the next decade and makes specific financial suggestions as to how the city could administer changes to mitigate budgetary risk.

The biggest single takeaway from this is that the output is not a percent of something happening. It breaks down all the various scenarios and makes actionable recommendations (in this specific case) as to what is needed to maintain a healthy reserve fund. To show where these models could be headed, it also includes the impact of adding parametric insurance policies to cover the city in the case of natural disaster events.



PARAMETRIC INSURANCE INPUT IS A SIGN OF WHAT IS POSSIBLE

Parametric insurance is a type of insurance that differs from traditional indemnity insurance in its approach to payouts. A parametric policy pays out a predefined amount based on the occurrence of a specific trigger, it does not require claims adjustment as the trigger event is objectively measured and can be offered via a smart contract, which means much faster payouts to the policy owners.

An example: a parametric snow insurance parametric policy would be triggered if snow fall exceeded a pre-defined amount of snowfall within a specific timeframe. So if Providence purchased a parametric policy, during a heavy snowfall event, if the accumulated snowfall exceeded a threshold in a given time period, the city would receive a pre-agreed payout amount based on the severity of the event.

The benefits here are the transparency, it can cover indirect losses that are not easily quantified through a typical policy (like business interruption), and it allows for improved budget planning as matching impact with a policy is better defined. They do tend to have higher premiums as they are not as widely used/understood and the basis risk is not the same as it is not directly linked to damages and the trigger might not perfectly reflect the city's actual expenses.

That the early models of this initiative include parametric insurance is important for two reasons: 1) it demonstrates adaptability and 2) includes detailed climate data that has many more uses than just parametric policies.

1) This initiative is flexible and is being built to have add-ons. There are any number of directions these models can go. It has roots in Monte Carlo simulation, a mathematic technique used to estimate possible outcomes of an uncertain event by relying on related random sampling. Probability Management extends Monte Carlo by storing these samples as auditable data that may be shared between applications, for example, between Aon hazard simulation and a GFOA excel dashboard. This model runs hundreds of thousands of scenarios to assess the probably of such event and then calculates how any number of variables would have a financial impact on a local budget. That is just the start.

2) The level of detail provided by Aon - which by our account is the leader in climate risk assessment and is used by virtually every insurance and reinsurance company in the world is good enough to be used for a parametric smart contract means this data has numerous other implications. Geo-spatial data would be a next logical step to leverage the data to not only understand the financial implications for a community but perhaps to be leveraged for improved design, sustainability and environmental stewardship where the balance of people and nature is better understood.

WHY THIS MATTERS:

The way in which local governments make climate risk assessment is hugely different from community to community and is also largely reliant on static federal government programs and tools. The lack of consistency, the failure to apply modern data and technology and abysmal communication between all parties at the local, state and federal levels (not to mention private parties and community leaders) is costing this country too many lives and billions of dollars annually.

If even partially functional, more governments would be able to budget better and potentially save money and have a better informed community. If fully functional, probability management has the capability to reconfigure the business of government risk management, lower insurance costs, better support preparedness and emergency response at all levels of government and, in general, be on much better footing for a world where the 100-year flood happens every few years.

This could very well usher in a new era of government risk assessment. This group does not have a proposition to lower world temperatures or change where people are building new communities where 1 in 3 in the U.S. are in the so-called wild land-urban interface, but it does propose a radically more informed way to better secure governments financially and could be used to eventually help communities address climate volatility in a holistic fashion.

Let’s encourage the GFOA and their partners to build the Civic Foundry.