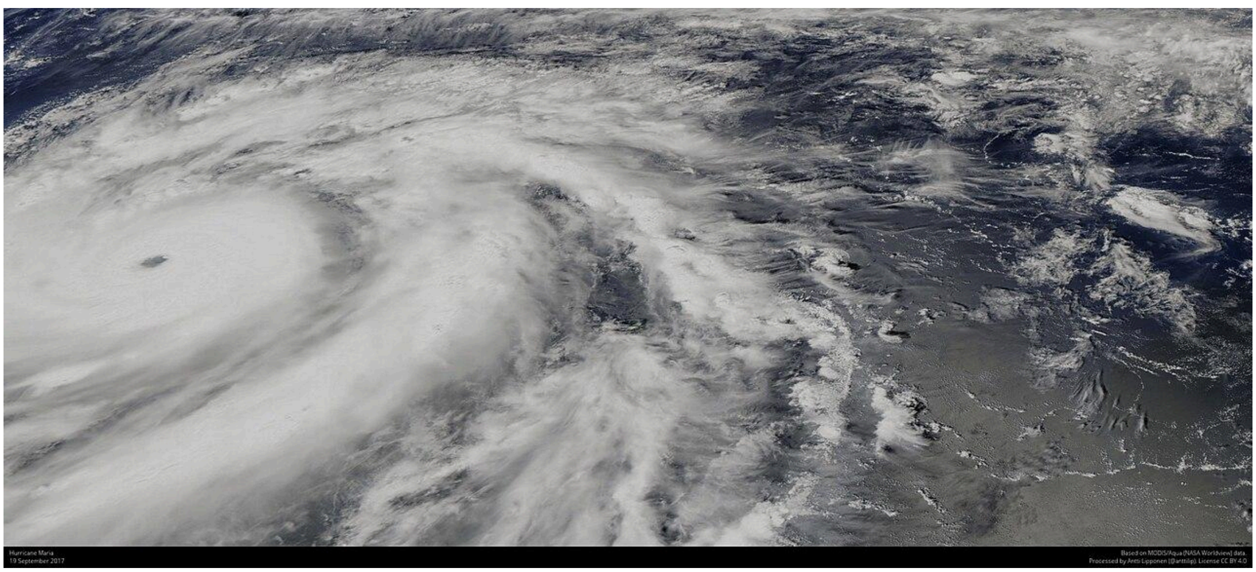
Disaster Data's Shaky Foundations Undermine Relief

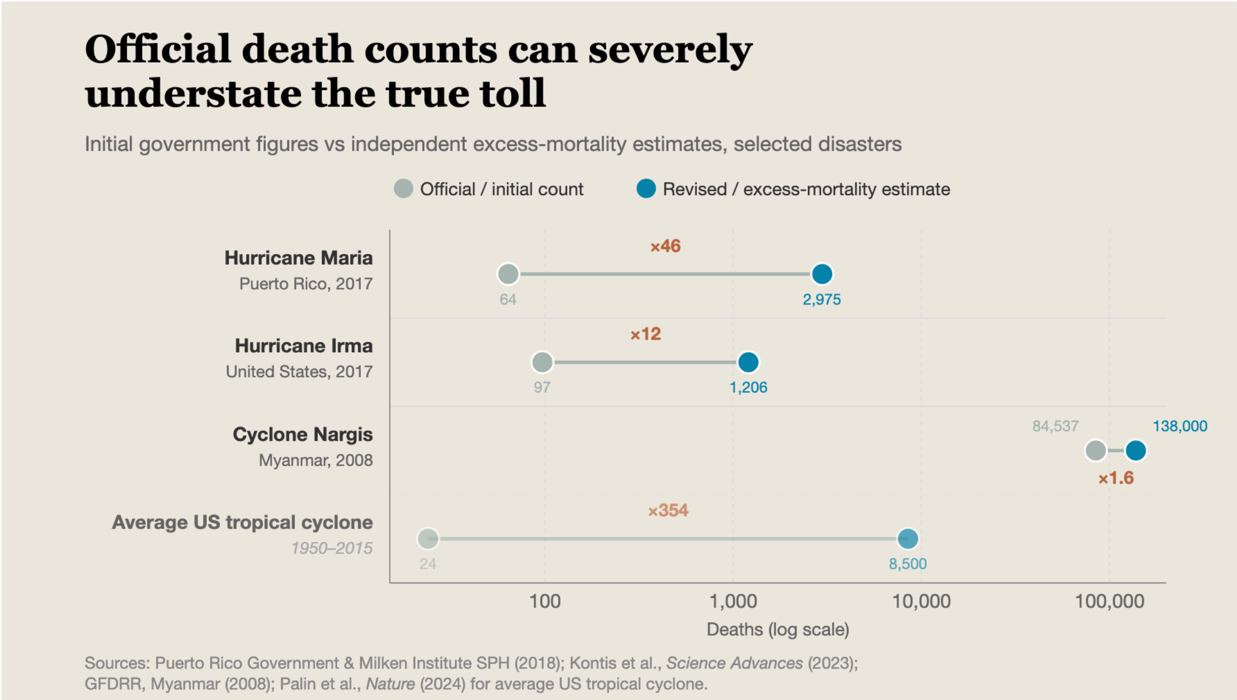
Matheus de Souza

Hurricane Maria hit Puerto Rico in September 2017. In the days following the hurricane, the government reported just 64 casualties. This number reflected only those directly killed by the hurricane - those found the next morning or soon after. But this did not include the thousands who died in the weeks and months after the disaster. Maria hit the infrastructure of Puerto Rico hard: there were major power outages that shut down hospitals, medical supplies ran out, and other critical infrastructure across the island collapsed. In a special assessment commissioned by the government of Puerto Rico a year later, a team of researchers revised the number of deaths after the event. The total count rose to 2,975 - over 40 times higher than the original estimate.



(Image: Hurricane Maria from satellite; image by Antti Lipponen, licensed under CC-BY.)

Hurricane Maria's example is not unique. In many countries, the databases used to track the impact of disasters can be badly wrong.



They rely mainly on government and news reports - but those shaped by when governments choose to report and how these governments define what counts as disaster impact. The data isn't just used for academic purposes; disaster figures weigh heavily in today's world. They can influence which countries receive funding and where disaster funds are spent.[1]

While these decisions are often framed as technical, there is a political dimension to disaster reporting. The data can often determine whose suffering is recorded and prioritized. We treat these figures as facts, but they are not. They are generated by systems, with the same fragilities as any other policy realm. Disaster data is far less reliable than its users often assume.

The criteria for good data is not controversial: it should reflect what actually happened, capture the full picture, remain comparable across time and geography, and not count the same event twice. Unfortunately, we are far from achieving that.

How disaster databases actually work

We need data from disasters. Recovery efforts must be planned, humanitarian assistance delivered, and resilience plans made. The Emergency Events Database (EM-DAT) is the

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[1] For instance, United Nations (UN) Central Emergency Response Fund (CERF) uses the INFORM Risk Index as part of its analysis to identify underfunded emergency allocations and recommend the size of their funding.

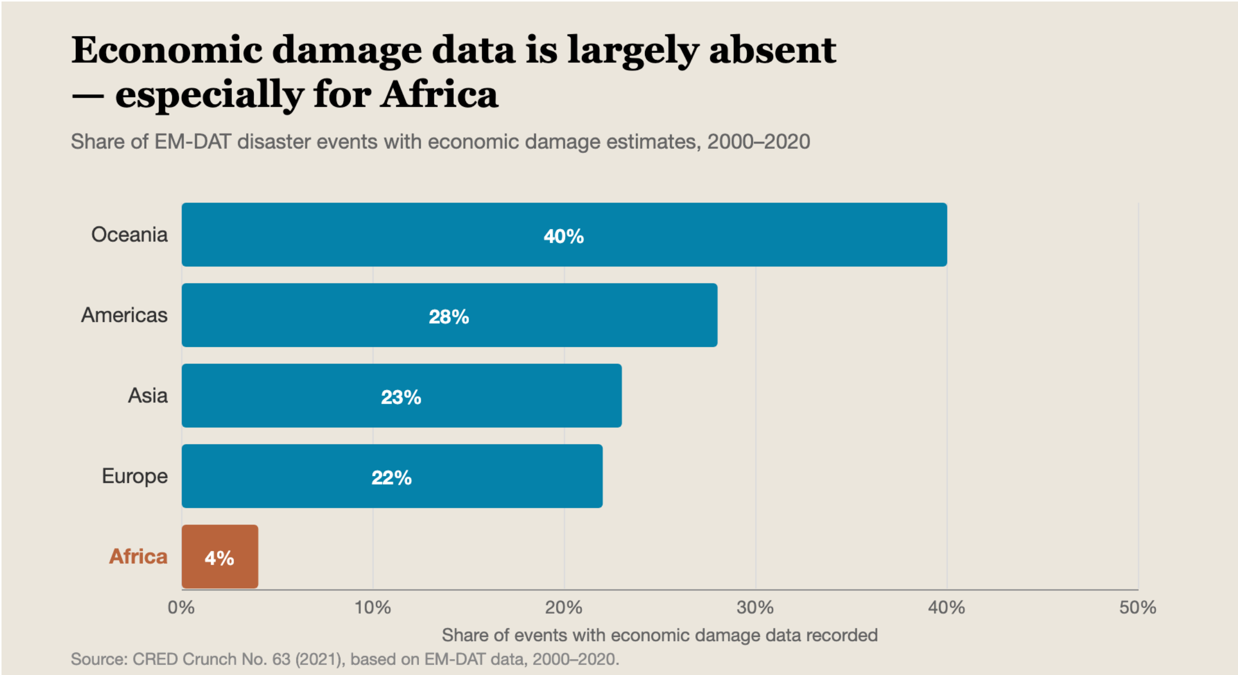
most widely used free source of global disaster data, covering both technological and natural hazards. It has records of more than 27,000 events since 1900. For an event to be included, it must meet at least one of four main criteria: 10 or more people killed, 100 or more people affected, a declaration of a state of emergency, or a call for international assistance.

While reasonable, these criteria mean the dataset has blindspots. A drought that killed 9 people will typically not be included in the database, unless it triggers an emergency declaration or an international call for aid. The same occurs for a flood that affects 95 people. And there's an important caveat there - it is focused on reported people affected or killed. If the reporting isn't accurate, neither is the database. EM-DAT requires cross-verification of each event from at least two independent sources, which are often international agencies, wire services, and English-based media.

Given this, geographical bias in media reporting is likely to propagate into the EM-DAT database itself, leading it to capture more disaster events in developed economies than in less developed ones. It also lets governments manipulate the data. If the government only admits to nine deaths, it won't be included - even if there are far more. This lets governments evade accountability for their actions.

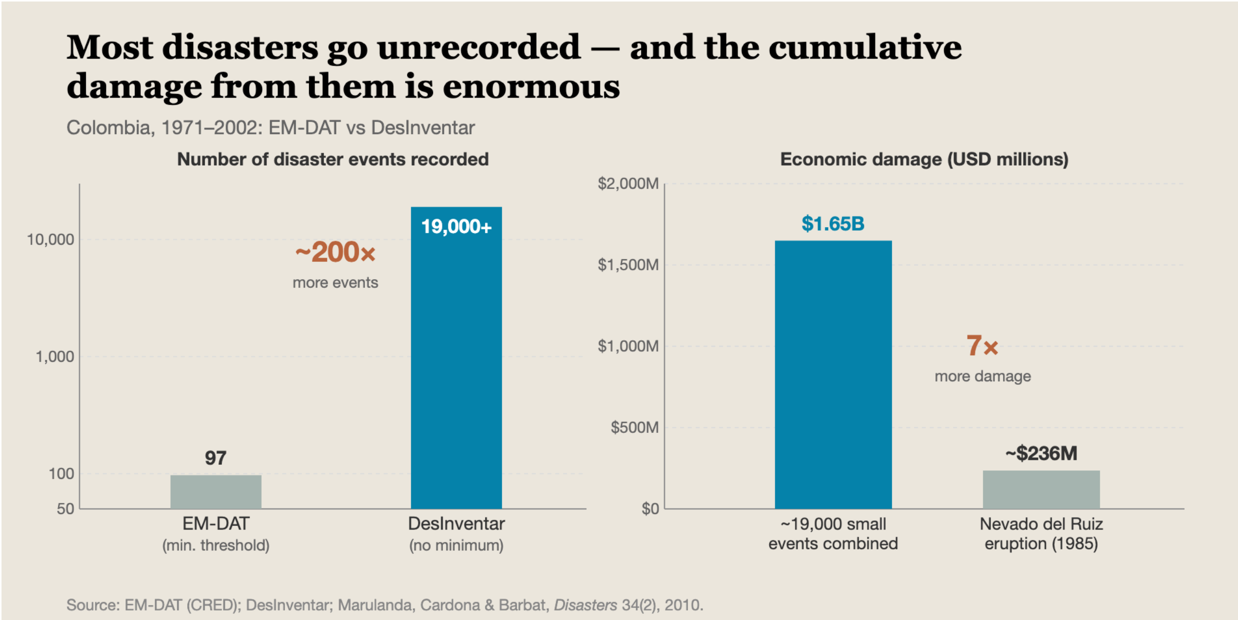
Consider the 2008 Sichuan earthquake in China. Sichuan had largely been left behind during China's rise, and many buildings collapsed. However, the Chinese government found this embarrassing, preferring to project an image of a rising power. They insisted that the death toll was no more than 70,000. Parents, activists, and journalists who tried to seek accountability and investigate the collapse of buildings and construction codes were targets of censorship, detention, and lawsuits; no one will ever be certain how many truly died.

Even when an event meets the thresholds, other information may be incomplete. Economic losses information is the main source of missingness; it is unavailable for 80% of the events recorded from 2000 to 2020. Economic damages are hard to calculate, and are rarely provided in low- and middle-income countries. Just 4% of African disasters have economic damage estimates.



But this doesn't stop people from using the data off-the-shelf. A growing number of publications, highly influential and widely cited, use this data for empirical studies with very limited acknowledgement of its problems.

The scale of the limitations becomes clearer when you compare disaster databases. Between 1971 and 2002, EM-DAT recorded 97 disasters in Colombia. Another database, DesInventar, recorded more than 19,000 in the same period. Only a small percentage of the local events of DesInventar would meet EM-DAT's definition of a disaster, but when we combine the 'small' events in Colombia they exceed more than US$1.65 billion in damages. This is around seven times the economic losses caused by one of Colombia's deadliest disasters, the Nevado del Ruiz volcanic eruption, one of Colombia's deadliest disasters. Together, these "small" events pack a big punch.



DesInventar represents a different type of disaster database. Instead of setting specific criteria for inclusion, DesInventar allows countries to freely build their own disaster inventories. In general, this means that it includes smaller disaster events, but it also means the quality of the data included within the database depends on each government's capacity to collect and maintain records. This can vary considerably. Peru is a prime example. Their data uses a single source - and events near Lima are far better covered than events in more remote parts of the country.

Nor is that the only discrepancy. The count of those who are "affected" can vary substantially. EM-DAT defines those affected as requiring immediate assistance, but countries have different standards for what is considered "assistance". Some include all those in the disaster zone, others include only those who lost housing, while still others count assistance requests as the parameter. Countries might even strategically choose who counts as affected, because such data can help determine if a country qualifies for climate adaptation financing or not.

Other categories of data are even murkier. As noted, economic damage estimates are often missing and where they do exist, the data is… sketchy at best. Others, comparing disaster events between EM-DAT and DesInventar, found that Damage figures, comparing EM-DAT and DesInventar diverged by more than 20% in *most* cases.

Turning disaster data into policy

This may seem an academic concern. It is not. These databases are used in real policy decisions.

UNDRR uses both EM-DAT and DesInventar for its [Global Assessment Reports on Disaster Risk Reduction](), one of the main publications guiding international disaster policy. United Nations Member States also report their progress through the Sendai Framework Monitor. The Sendai Framework Monitor uses disaster databases as inputs. This is then used to track progress, identify disaster-risk priorities, guide resource allocation toward risk-reduction, and help plan climate adaptation strategies.

Climate finance, a sector that moved US$1.9 trillion in 2023 alone, also uses disaster databases to assess climate-related disaster risk. Countries often use Germanwatch's Global Climate Risk Index to discuss the need for funding support for adaptation or losses. But Germanwatch uses EM-DAT with few caveats, and can use older (and unreliable) data. This loss and damage analysis, for instance, uses an older version of the index with no notes about the limitation.

The reliance on EM-DAT goes beyond the Global Climate Index and into the operational structures that determine humanitarian funding flows. The INFORM Risk Index, uses EM-DAT for a few of its hazard indicators and has been used by the United Nations Office for Coordination of Humanitarian Affairs, the European Commission's Humanitarian Aid Operations, the World Food Program, the United States Agency for International Development, the UN Central Emergency Response Fund and more to prioritize and allocate humanitarian resources. Mistakes in EM-DAT could leave disasters underfunded - for instance, if many more people died than EM-DAT was aware of because the reporting was not in English.

In 2015, the Malawi government paid US$5 million for drought insurance through the African Risk Capacity (ARC), which pays out when its model estimates a drought has crossed a given threshold. After the 2016 El Niño drought, which left 6.5 million people in need of aid, the model initially found that no payout was warranted, based on a false assumption regarding the maize variety farmers had planted. A payout was made in 2017, by which point the response had cost around US$395 million.

Building a firmer ground: six fixes

We clearly need disaster data. Without databases like EM-DAT, DesInventar, and others, we would not be able to understand and respond to disasters. It would be far more difficult to respond to climate change, and plan adaptation strategies to prevent future disasters. But they are far from perfect.

Improvement is possible, though. As the world warms, and climate-related disasters become more frequent, indeed, improvement is necessary.

We must begin to treat disaster databases as not a single source of truth, but as part of a system. Each disaster database is a measurement tool with reported limitations, but considering them together can limit the errors. Resource allocation should be triangulated between different disaster databases and local disaster inventories. This will help limit missing data - especially important given that smaller, recurring events represent an important share of the disaster impact.

Secondly, disaster impact should be reported in ranges, not in a headline figure alone. It is too easy for policymakers to focus on a single number, without taking into account the uncertainty behind a single number. The Integrated Research on Disaster Risk programme, in 2015, recommended that disaster data should include reliability information such as a quality score or uncertainty level. Hurricane Maria showed mortality figures 46 times lower than those produced by the excess mortality analysis. A reporting range would not have eliminated the discrepancy, but it would signal to policymakers that the number was provisional rather than definitive.

Third, we must verify official counts independently. Governments are not always incentivized to tell the truth, and even if they are attempting to tell the truth, different standards can lead to vastly different estimates of damage. Instead of relying on a count of people in a damaged area, we should instead focus on excess mortality as a standard post-disaster metric. This would provide an independent data point against which official figures can be assessed.

We can also use satellite imagery to validate data. This was used to great effect after the Haiti earthquake in 2010, as well as in Turkey after the 2023 earthquakes.These technologies do not replace ground-level data collection, but they provide another form of independent analysis that can be used to compare against figures that enter disaster databases. This is particularly useful in contexts with weak data collection or reporting infrastructures.

The fourth fix goes hand in hand with this. We must also better fund local data systems. Several countries have adopted DesInventar-based systems for their own disaster loss accounting, but there are few incentives for maintaining these systems. They require training personnel, validation activities, and a chain of interconnected systems. International organizations should help support this where possible.

Fifth, make the limitations of the data limitation visible. No policy document should use disaster data with no caveats or notes about the limitations of the data. Full disclosure - like SDG monitoring metadata, the INFORM's reliability score, and the Climate Analytics' loss and damage briefing - should be the standard in policy-adjacent documents (recommendations, briefs, etc) that cite disaster data.

Together, implementing these fixes would help countries better prepare for future disasters. Right now, disaster databases risk mistaking what is currently reported (and recorded) for what matters in terms of policy. If they are to guide funding and policy decisions alone, they must be treated as crucial inputs into decision making processes.

The systems built to account for the impacts of disasters, including who was affected, the size of the human losses, and the economic cost, will always carry intrinsic assumptions, political pressures, and institutional limitations that define what is seen and what is missed in the final data output. But we can do better than the current system - without fixes, researchers investigating the relationship between climate change and disaster frequency, policymakers deciding in which communities to invest for adaptation financing, and donors allocating recovery aid will continue to make preventable mistakes.

Matheus de Souza is a PhD student in Disaster Science and Management at the University of Delaware, and has worked with different humanitarian organizations such as the United Nations High Commissioner for Refugees and the Norwegian Refugee Council. He studies several aspects of disasters, with a focus on inter-organization coordination.

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