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Extreme natural events and disasters in Latin America and the Caribbean 1990-2022: a statistical review

Contents

Disasters disrupt countries' economies and affect human lives, with major direct and indirect impacts and costs for individuals, communities, and nations, and remain one of the greatest global development challenges facing humanity. The capacity of a community or country to manage the impact of a hazard event or disaster depends greatly on the event's intensity, impact, and severity over time, but also on the level of preparedness and resilience of communities in the affected region.

While many disasters occur with little or no warning, their impacts are immediate, cross-cutting, complex, often dynamic, unselective and, in today's world, increasingly frequent and severe. When their onset rates are considered, however, some differences can be distinguished. Sudden or rapid-onset events, such as extreme weather, earthquakes, floods, and forest fires, tend to be more localized but potentially very destructive for people, buildings, and infrastructure. They also quickly put severe strains on preparedness, resilience, and social well-being within and between the communities affected. Slower-onset disasters, such as sea level rise, climbing temperatures, forest degradation, biodiversity loss and desertification are often intergenerational and difficult to measure, quantify and resist. To these conditions must be added, furthermore, that all such events are being exacerbated by the effects of climate change, particularly those related to extreme weather phenomena (United Nations, 2019).

In the last 30 years, according to the United Nations Office for Disaster Risk Reduction, one in every four disasters has occurred in Latin America and the Caribbean. For the same period and region, the EM-DAT International Disaster Database reports that disasters have caused a total of 319,532 deaths, affected more than 205 million people, and inflicted an estimated US$ 327 billion in economic losses.

The EM-DAT database and project were created in 1988 as a joint initiative between the Centre for Research on the Epidemiology of Disasters and the World Health Organization, and are primarily sponsored by the United States Agency for International Development and the Office of Foreign Disaster Assistance of the Catholic University of Louvain in Brussels.

EM-DAT has the world's most extensive disaster register. However, it only considers a disaster to have occurred when at least one of the following criteria is met: 10 or more people reported dead; 100 or more people reported affected; declaration of a state of emergency or call for international assistance. In addition, EM-DAT does not record small-scale disasters, which account for more than half the human losses caused by climate events in Latin America and the Caribbean, according to the United Nations Office for Disaster Risk Reduction. It is also important to mention that less than 40% of the reports included in EM-DAT contain economic data. Thus, EM-DAT only tells part of the story.

This study presents a review of disaster-related statistics and indicators. It includes global frameworks and some of the main standardized and approved concepts that cater to the demand for disaster statistics and indicators. It also shows the number of events, the number of people killed, the number of people directly affected and the value of all damages and economic losses directly or indirectly related to disasters to give an idea of the state of affairs in the region.

1. Conceptual framework

The first step is to review some of the terms used in the global indicators available for disaster risk reduction. These terms and definitions are just some of those that were presented to the United Nations General Assembly by the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction and approved by the Assembly in February 2017, in resolution 71/276:

- Extreme event: an event of natural origin that is rare at a particular place and time of year, meaning that it is as rare as or rarer than the tenth or ninetieth percentile of a probability density function.
- Disaster: a serious disruption of the functioning of a community or a society at any scale owing to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.
- Disaster risk: the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.
- Vulnerability: the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.
- Resilience: the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through

the preservation and restoration of its essential basic structures and functions through risk management. In this document it will be treated as the opposite of vulnerability.

- Capacity: the combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience. Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.
- Exposure: the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.

A. Global frameworks

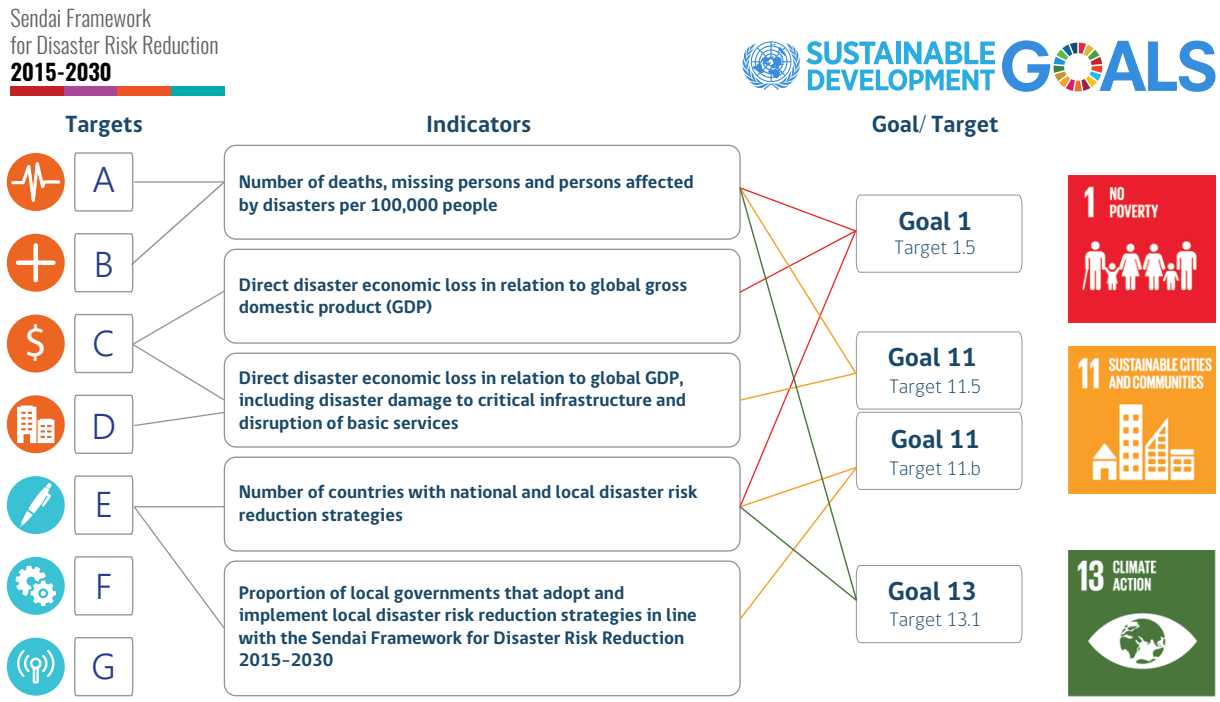
Disasters can quickly erode the hard-won development gains of countries in the region where there is a relative paucity of financial resources and available capital. Certain factors present in poverty settings will often turn a natural hazard event into a disaster. In developing countries, communities are much less prepared for the impact of a disaster, so people are trapped in a cycle of poverty left by natural disasters, lacking the resources to rebuild their homes and meet other basic needs. This situation diminishes the capacity of these communities to recover in the medium and long term.

The Sendai Framework for Disaster Risk Reduction provides mechanisms for addressing disaster risk reduction and disaster resilience-building with a renewed sense of urgency in a context of sustainable development and poverty eradication. It also provides for the integration, as needed, of both disaster risk reduction and resilience-building into national policies, plans and programmes at all levels. For its part, the 2030 Agenda for Sustainable Development specifically calls on all countries to substantially increase their capacity to adopt and implement integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change. Furthermore, in line with the Sendai Framework, it encourages disaster resilience and the development and implementation of holistic disaster risk reduction and management at all levels.

The adoption of a common reporting mechanism for the Sendai Framework and the 2030 Agenda for Sustainable Development has led the international statistical community to step up support for the development of disaster-related statistics. In particular, when it comes to the 2030 Agenda, the goals for ending poverty (Goal 1), sustainable cities and communities (Goal 11) and climate action (Goal 13) present targets for reducing vulnerabilities and exposure to disasters and strengthening resilience to these extreme events.

As can be seen in diagram 1, the indicators established to track the seven Sendai Framework targets form part, on an aggregated basis, of the disaster-related indicators in the global indicator framework for following up the implementation of the Sustainable Development Goals (SDGs). In February 2017, the United Nations General Assembly endorsed 38 indicators recommended by the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction for monitoring the 7 global targets of the Sendai Framework. In addition, these 38 indicators form part, albeit on an aggregated basis, of the 5 disaster-related indicators in the global indicator framework of the 2030 Agenda.

» Diagram 1. Linkages between the Sendai Framework and the Sustainable Development Goals



Source: United Nations Office for Disaster Risk Reduction (UNDRR), Global Platform for Disaster Risk Reduction, 2019.

In the context of the global indicator framework of the 2030 Agenda, governments have increased their focus on disaster-related statistics since the adoption of the Sendai Framework for Disaster Risk Reduction 2015-2030. All global development agendas (e.g. the 2030 Agenda for Sustainable Development, the Paris Agreement on Climate Change, the Samoa Pathway and the New Urban Agenda) emphasize the social, economic and environmental impacts of disasters and their negative effects on people, economies and countries, particularly developing countries and vulnerable sectors of society.

The Economic and Social Commission for Asia and the Pacific (ESCAP) has developed the Disaster-related Statistics Framework (DRSF), a basic guide to disaster-related statistics and tools for implementing them. DRSF is designed to improve the quality and harmonization of statistics as a support for follow-up of the Sendai Framework for Disaster Risk Reduction 2015-2030 and the SDGs.

The United Nations Statistics Division has recently developed and made available the Global Set of Climate Change Statistics and Indicators, which was adopted at the fifty-third session of the United Nations Statistical Commission in March 2022. This also serves as a framework for climate change statistics and indicators that countries can use as their priorities and resources determine. To this end, the Statistics Division has developed the Climate Change Statistics and Indicators Self-Assessment Tool (CISAT), which has been tested in several countries in the Caribbean and South America regions.

Disaster statistics are fairly new to most countries in the world, so there is great international demand for technical assistance and knowledge about tools and good practices. ECLAC is a pioneer in disaster assessment. With experience of more than a hundred assessments in the region, it has developed the Damage and Loss Assessment (DaLA) methodology. DaLA is a key input for reconstruction planning, as it provides sectoral and geographical estimates of the costs of an event.

To speed up progress in implementing the conceptual frameworks for disaster statistics in the region, the ECLAC Statistics Division, working through the Environment and Climate Change Statistics Unit, has augmented its technical assistance activities with workshops on identifying and constructing disaster-related statistics and indicators and with the promotion of Spanish-language e-learning material on disaster statistics developed by the Economic and Social Commission for Asia and the Pacific. These activities include technical capacity-building in the countries so that they can monitor the 2030 Agenda, the Sendai Framework and the Global Set of Climate Change Statistics and Indicators.

2. Disaster statistics

The core disaster monitoring concepts and indicators have been set out in the Sendai Framework, the SDGs and the Global Set of Climate Change Statistics and Indicators. However, agreed concepts and definitions are still needed so that specific, harmonized technical instructions and recommendations can be provided for the production and dissemination of these statistics. Basic requirements include the comparability of concepts and methods across countries and over time for measuring not only the occurrence of a disaster (e.g. dates, magnitude and affected areas) but also disaster risk identification and prevention measures and the reconstruction and resilience efforts of populations and communities.

According to the Sendai Framework, understanding disaster risk requires greater development and dissemination of science-based methodologies and tools for recording and reporting disaster losses. At the same time, there is a need to develop and integrate disaggregated data and statistics and to improve modelling, assessment, mapping and monitoring in relation to disaster risk and multi-hazard early warning systems.

A. Statistics on disasters in the region

There can be no solutions without measurement. It is imperative to have consistent and reliable statistics so that the countries can develop disaster prevention policies as part of their public policies for sustainable development. In the region, the diversity of the countries' approaches means there are differences in conceptual treatment, theoretical gaps, inconsistencies and limitations in the management, classification and consolidation of data useful for the calculation of disaster indicators.

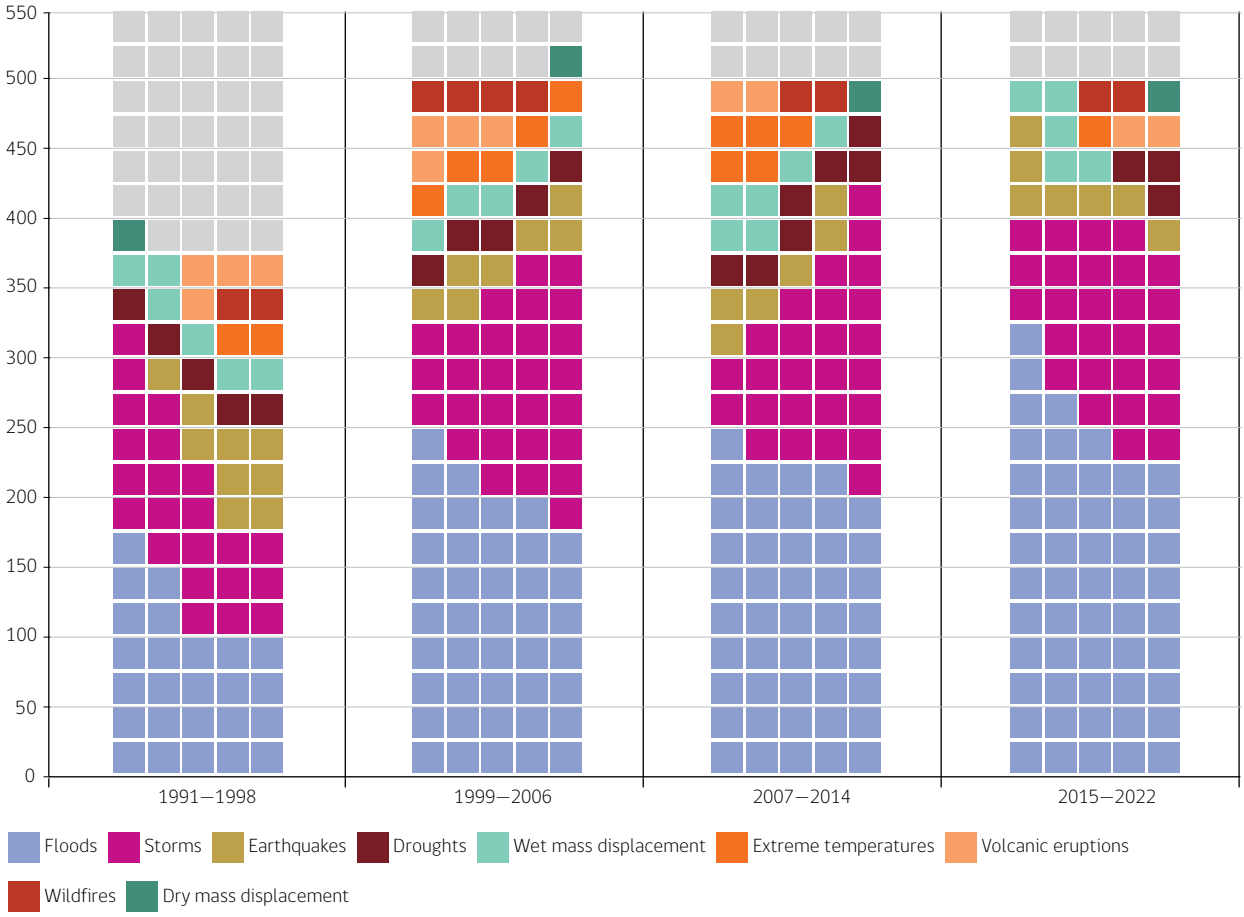
A disaster disrupts the lives of communities and the economic activity of countries. This section shows indicators that can be used for a global comparison. These indicators are found in the 2030 Agenda and the Sendai Framework and provide a brief review of the evolution of disasters and some of the commonly used measures of severity.

Number of events

A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, economic or environmental losses that overwhelm the ability of the affected community or society to confront the situation with its own resources. Figure 1 provides information on nine types of disaster: earthquakes, volcanic eruptions, floods, wet mass displacement, dry mass displacement, storms, extreme temperatures, droughts and wildfires. These disasters are further classified into two groups: geophysical (earthquakes, volcanic eruptions and dry mass displacement) and climate change-related (storms, floods, wet mass displacement, extreme temperatures, droughts and wildfires).

» Figure 1. Latin America and the Caribbean: extreme events and disasters, 1991–2022

(Number of events)



Each square represents five events, except in the case of dry mass displacement, for which each square represents less than two events.

Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Statistical Yearbook for Latin America and the Caribbean, 2022* (LC/PUB.2022/21-P), Santiago, 2023.

Note: The data for this indicator can be consulted as "Occurrence of climate change-related and geophysical disasters" in the "Natural extreme events and disasters" section of "Statistics and Indicators, Environmental" in CEPALSTAT [online] https://statistics.cepal.org/portal/cepalstat/dashboard.html?theme=3&lang=en.

The chart shows that floods, storms and earthquakes, in that order, are the disasters that have occurred most frequently in the region since 1991. It also shows that 100 more disasters were reported in the period 2015-2022 than in 1991-1998. This increase can be explained by the effects of climate change, as extreme air and water temperatures cause more intense and prolonged storms, droughts and fires and heavy precipitation leading to floods, in addition, of course, to the build-up of greenhouse gases.

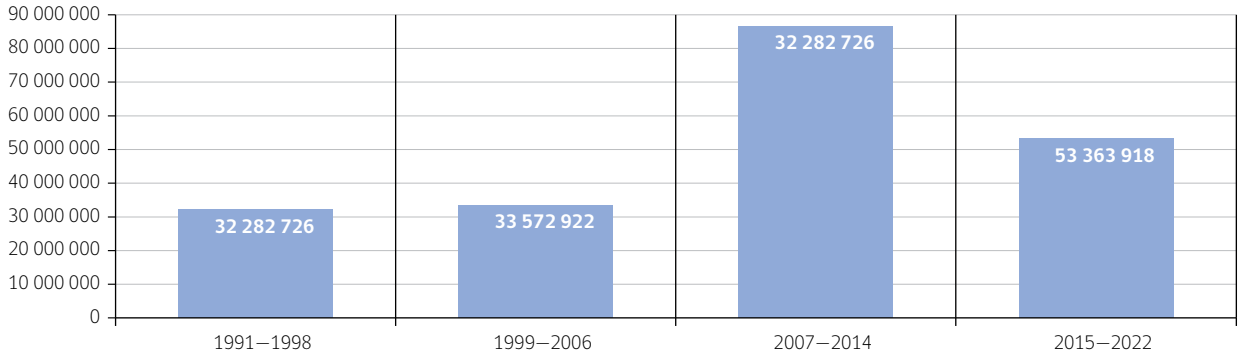
After observing the evolution of disasters, we can observe and analyse some of the available measures of the severity of these disasters for the same periods, such as the number of people directly affected and the number killed.

Figure 2 shows the reported numbers of people affected, being the sum of the total numbers injured, left homeless and otherwise affected. This indicator shows the number of people requiring immediate basic assistance, including food, water, shelter, sanitation and medical care, in a disaster emergency period. Figure 3 shows the number of people killed, which includes those confirmed dead and those missing and presumed dead as a result of the disaster.

Directly affected persons

» Figure 2. Latin America and the Caribbean: directly affected persons by disasters, 1991–2022

(Number of directly affected persons)



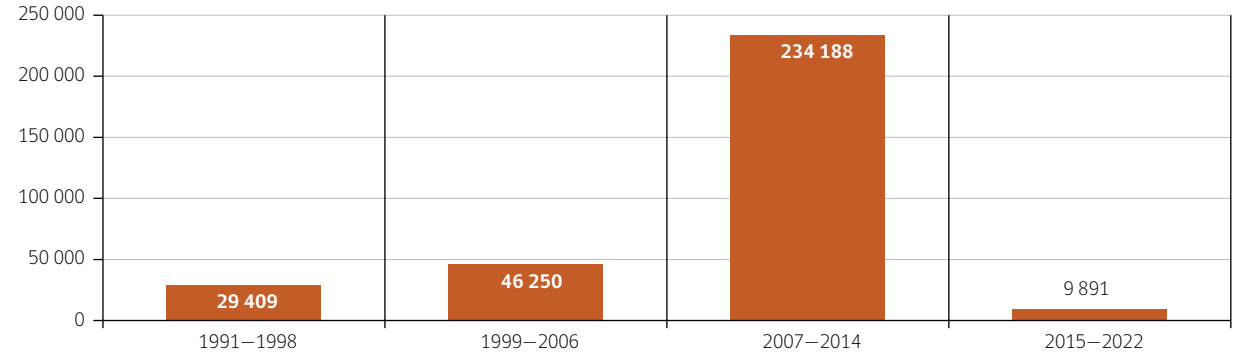
Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Statistical Yearbook for Latin America and the Caribbean, 2022* (LC/PUB.2022/21-P), Santiago, 2023.

Note: The data for this indicator can be consulted as "Occurrence of climate change-related and geophysical disasters" in the "Natural extreme events and disasters" section of "Statistics and Indicators, Environmental" in CEPALSTAT [online] https://statistics.cepal.org/portal/cepalstat/dashboard.html?theme=3&lang=en.

Human deaths

» Figure 3. Latin America and the Caribbean: human deaths caused by disasters, 1991–2022

(Number of human deaths)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Statistical Yearbook for Latin America and the Caribbean, 2022* (LC/PUB.2022/21-P), Santiago, 2023.

Note: The data for this indicator can be consulted as "Occurrence of climate change-related and geophysical disasters" in the "Natural extreme events and disasters" section of "Statistics and Indicators, Environmental" in CEPALSTAT [online] https://statistics.cepal.org/portal/cepalstat/dashboard.html?theme=3&lang=en.

The period 2007-2014 is an outlier in both charts, with more than 85 million people reported affected and more than 200,000 killed by disasters. According to the data, the same number of disasters was reported for the last two time periods included in these charts (see figure 1), but a significant change can be identified in the impact of these disasters in terms of the number of people affected and deaths reported, as shown in figures 2 and 3. The number of people affected in 2015-2022 was more than 43 million lower than in the previous period, a drop of 40%. When the same analysis is performed for the indicator on the number of people killed, an even greater

decrease relative to the previous period is seen, from more than 200,000 deaths to less than 10,000, a drop of 96%. With these data, we can say that the countries appear to be better and better prepared, have worked on their resilience and are apparently more equipped to adapt to the impact of a disaster.

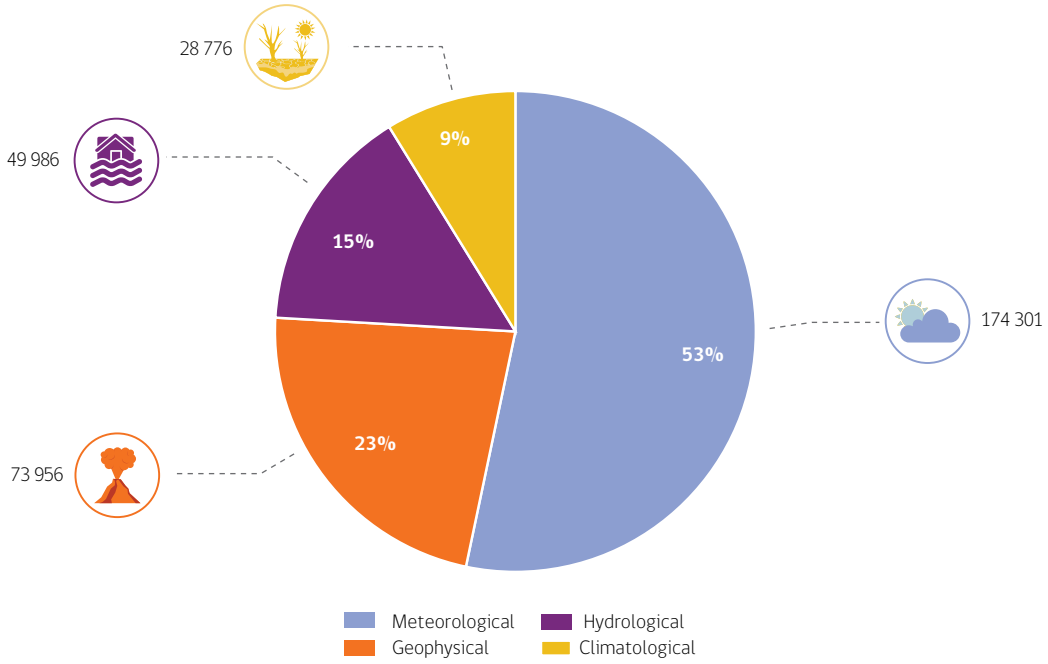
B. Disaster impact statistics

Disasters, whether natural or man-made, cause loss of life and damage to livelihoods. According to the World Bank Group, the immediate expenditure requirements for disaster response and reconstruction are compounded by a weakened economy, infrastructure damage, the destruction of businesses, lower tax revenues and higher poverty. This section analyses cumulative economic damage and losses directly or indirectly related to disasters, disaggregated by disaster type, and their evolution in the period 1970-2022.

Figure 4 shows that, for the reference period, 77% of disasters fall into the climate change-related meteorological, climatological and hydrological categories. Furthermore, the same chart shows that the cumulative economic cost of these three types of disasters amounts to just over US$ 253 billion. Geophysical disasters represent the remaining 23%, and their economic cost amounts to just under US$ 74 billion for the period. It is important to note that EM-DAT avoids double (or multiple) counting in regional or subregional aggregations of its data by assigning a single code to each event to be recorded. In the case of a storm affecting several Caribbean countries, for example, the subregional and regional aggregate is reported as a single event.

» Figure 4. Latin America and the Caribbean: cumulative economic cost of disasters, by type of disaster, 1970–2022

(Millions of dollars and percentages)



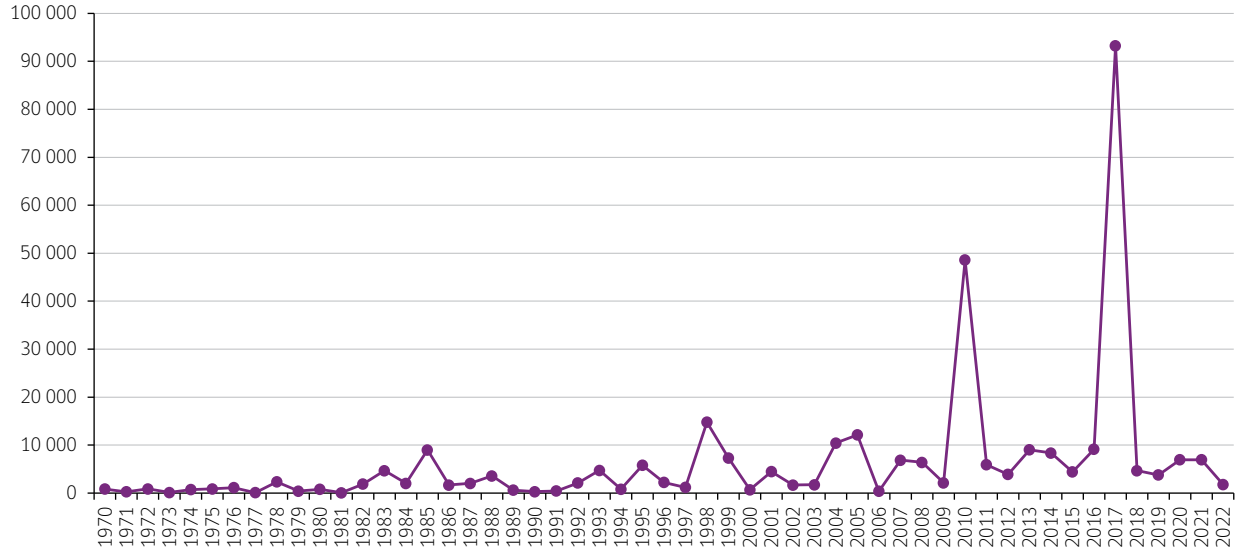
Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Statistical Yearbook for Latin America and the Caribbean, 2022* (LC/PUB.2022/21-P), Santiago, 2023.

Note: The data for this indicator can be consulted as "Occurrence of climate change-related and geophysical disasters" in the "Natural extreme events and disasters" section of "Statistics and Indicators, Environmental" in CEPALSTAT [online] https://statistics.cepal.org/portal/cepalstat/dashboard.html?theme=3&lang=en.

Figure 5 shows the evolution of the economic costs of disasters in the region included in EM-DAT. The year 2017 may look like an outlier, but the region suffered a series of devastating disasters, with an active hurricane season (including two category five storms, Irma and Maria), a tropical storm in Central America (Nate), floods in Peru, landslides in Colombia and two major earthquakes in Mexico resulting in reported disaster damages and losses of almost US$ 100 million. However, it should be recalled that these figures are based on economic data provided in the reports submitted to EM-DAT and that less than 40% of those reports include this type of data.

» Figure 5. Latin America and the Caribbean: economic cost of disasters, 1970—2022

(Millions of dollars)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), *Statistical Yearbook for Latin America and the Caribbean, 2022* (LC/PUB.2022/21-P), Santiago, 2023.

Note: The data for this indicator can be consulted as "Occurrence of climate change-related and geophysical disasters" in the "Natural extreme events and disasters" section of "Statistics and Indicators, Environmental" in CEPALSTAT [online] https://statistics.cepal.org/portal/cepalstat/dashboard.html?theme=3&lang=en.

IV. Conclusions

Disaster-related statistics and indicators are cross-cutting and multi-domain. Their production thus requires strong coordination between national statistical offices and the agencies and institutions that generate disaster response information: ministries of health, civil protection, agriculture, and infrastructure and housing, to name a few.

It is important to remember that there are specific tools to support this data collection and the development of analysis and integration methodologies. The disaster-related statistics and indicators mentioned in the Sendai Framework, the 2030 Agenda and the Global Set of Climate Change Statistics and Indicators are a good basis for building integrated systems at the country level that maintain international comparability and consistency.

There is growing agreement on the need for a holistic approach to disaster data collection, analysis and management that can support short- and long-term development goals and help to identify disaster risks and thence reduce them. Disaster risk reduction requires a multi-hazard approach and inclusive decision-making based on risk, on the participation of the whole of society and on the sharing and dissemination of data disaggregated by sex, age, disability, and other variables. These data can record the impacts, the effects and the path to recovery for people, communities, and their assets in multiple dimensions.

As one of its fundamental principles, the statistical community should explore the use of new data sources and technologies with a view to meeting society's expectations for improved products and more efficient working methods. This obligation has become more evident in the context of the 2030 Agenda, in which the statistical community was particularly requested to meet new demands for data to monitor and report on progress with the SDGs, targets and global indicators.

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