

Publication status: This preprint has not been published elsewhere.

Comparative analysis of data sources for measuring disaster-related displacement in Brazil

Richard Eustáquio Assis Moreira

<https://doi.org/10.1590/SciELOPreprints.17220>

Submitted on: 2026-07-30

Posted on: 2026-08-17 (version 1)

(YYYY-MM-DD)

COMPARATIVE ANALYSIS OF DATA SOURCES FOR MEASURING DISASTER-RELATED DISPLACEMENT IN BRAZIL

Moreira, R.E.A. ^{a*}

(a) PhD in Demography

ORCID: <https://orcid.org/0000-0001-6728-6056>. **LATTES:** <http://lattes.cnpq.br/2952566952725272>.

Article history:

Received 23 April, 2026

Accepted 20 June, 2026

Published 10 July, 2026

(*) CORRESPONDING AUTHOR

Address: UFMG. Av. Pres. Antônio Carlos, 6627, Pampulha, Belo Horizonte (MG), Zip Code:31270-901. Phone:(+55 31) 984094916.

E-mail: richardeamoreira@gmail.com

Abstract

This article comparatively analyzes six databases – Population in Risk Areas, Brazilian Integrated Disaster Information System (S2iD), Digital Atlas of Disasters in Brazil, Geological Survey of Brazil (SGB), Internal Displacement Monitoring Centre (IDMC) e Emergency Events Database (EM-DAT) – with the aim of assessing their potential to measure and characterize disaster-induced population displacement in Brazil, as well as to support the monitoring and targeting of public policies. The methodology adopted is exploratory and non-exhaustive, based on the analysis of databases according to five indicators: (i) capacity to measure displacement; (ii) level of sociodemographic disaggregation; (iii) territorial scale of data availability; (iv) methodological consistency; and (v) potential for use in public policies. The results indicate that the databases have complementary potential for the study of displacement, and can be mobilized both in ex-ante approaches, aimed at identifying exposed populations and reducing vulnerabilities, and in ex-post approaches, related to monitoring impacts and planning institutional responses. However, there is low articulation between the databases and differences in their levels of disaggregation, territorial coverage, and methodological consistency, which limits their integrated use and the production of more precise diagnoses of disaster-induced displacement.

Keywords: Disaster-Induced Displacement; Databases; Vulnerability; Public Policies; Brazil.

Resumo / Resumen

ANÁLISE COMPARATIVA DE BASES DE DADOS PARA MENSURAÇÃO DE DESLOCAMENTOS ASSOCIADOS A DESASTRES NO BRASIL

Este artigo analisa comparativamente seis bases de dados — População em Áreas de Risco, Sistema Integrado de Informações sobre Desastres (S2iD), Atlas Digital de Desastres, Serviço Geológico Brasileiro (SGB), Internal Displacement Monitoring Centre (IDMC) e Emergency Events Database (EM-DAT) — com o objetivo de avaliar seu potencial para mensurar e caracterizar deslocamentos populacionais induzidos por desastres no Brasil, bem como subsidiar o monitoramento e o direcionamento de políticas públicas. A metodologia adotada é de caráter exploratório e não exaustivo, baseada na análise das bases a partir de cinco indicadores: (i) capacidade de mensuração de deslocamentos; (ii) nível de desagregação sociodemográfica; (iii) escala territorial de disponibilização; (iv) consistência metodológica; e (v) potencial de uso para políticas públicas. Os resultados indicam que as bases apresentam potencial complementar para o estudo dos deslocamentos, podendo ser mobilizadas tanto em abordagens ex-ante, voltadas à identificação de populações expostas e à redução de vulnerabilidades, quanto em abordagens ex-post, relacionadas ao monitoramento de impactos e ao planejamento de respostas institucionais. No entanto, observa-se baixa articulação entre as bases e diferenças em seus níveis de desagregação, cobertura territorial e consistência metodológica, o que limita seu uso integrado e a produção de diagnósticos mais precisos sobre deslocamentos induzidos por desastres.

Palavras-chave: Deslocamentos Induzidos Por Desastres; Bases de Dados; Vulnerabilidade; Políticas Públicas; Brasil.

ANÁLISIS COMPARATIVO DE BASES DE DATOS PARA LA MEDICIÓN DE DESPLAZAMIENTOS INDUCIDOS POR DESASTRES EN BRASIL

Este artículo analiza comparativamente seis bases de datos — População em Áreas de Risco, Sistema Integrado de Informações sobre Desastres (S2iD), Atlas Digital de Desastres, Serviço Geológico Brasileiro (SGB), Internal Displacement Monitoring Centre (IDMC) e Emergency Events Database (EM-DAT) — con el objetivo de evaluar su potencial para medir y caracterizar desplazamientos poblacionales inducidos por desastres en Brasil, así como para apoyar el monitoreo y la orientación de políticas públicas. La metodología adoptada es de carácter exploratorio y no exhaustivo, basada en el análisis de las bases a partir de cinco indicadores: (i) capacidad de medición de desplazamientos; (ii) nivel de desagregación sociodemográfica; (iii) escala territorial de disponibilidad de los datos; (iv) consistencia metodológica; y (v) potencial de uso para políticas públicas. Los resultados indican que las bases presentan un potencial complementario para el estudio de los desplazamientos, pudiendo ser utilizadas tanto en enfoques ex-ante, orientados a la identificación de poblaciones expuestas y la reducción de vulnerabilidades, como en enfoques ex-post, relacionados con el monitoreo de impactos y la planificación de respuestas institucionales. No obstante, se observa una baja articulación entre las bases y diferencias en sus niveles de desagregación, cobertura territorial y consistencia metodológica, lo que limita su uso integrado y la producción de diagnósticos más precisos sobre desplazamientos inducidos por desastres.

Palabras-clave: Desplazamientos Inducidos por Desastres; Bases de Datos; Vulnerabilidad; Políticas Públicas; Brasil

INTRODUCTION

The debate on climate change and extreme environmental events has intensified over recent decades, accompanying the increasing frequency and severity of disasters, as documented in the reports of the Intergovernmental Panel on Climate Change (IPCC, 2023). Brazilian urban centers have experienced, annually, disasters that have resulted in growing numbers of displaced people, houseless population, and fatalities. In 2024, the state of Rio Grande do Sul experienced the largest disaster in its history, with municipalities recording cumulative rainfall exceeding 300 mm between April 25 and May 15. According to the Rio Grande do Sul Civil Defense (2024), approximately 388,781 people were displaced from their homes, and nearly 96% of the state's cities were affected. In a similar event, Belo Horizonte, the capital of the Brazilian state of Minas Gerais, recorded one of the most intense rainfall events in its history in 2020, with approximately 320.9 mm of rainfall between January 20 and 23, leaving more than 8,000 people homeless or temporarily displaced across the metropolitan region (Estado de Minas, 2020).

The production and use of data are central to informing public policies for disaster adaptation. Despite the growing availability of disaster-related databases in Brazil, there is still limited systematization and comparative assessment of these sources regarding their capacity to measure displacement. This limitation hinders the integrated use of available information and the development of consistent evidence on disaster-induced displacement.

Thus, this article aims to analyze and compare the databases used in Brazil to measure and characterize disaster-induced displacement, evaluating their potential to support monitoring efforts and inform public policy. For this purpose, different databases are examined based on indicators related to their capacity to measure displacement, level of disaggregation, territorial scale, and methodological consistency. The study adopts a descriptive, analytical, and documentary research design, drawing on the analysis of databases and empirical evidence on disasters and displacement. In addition to this introduction, the article is organized into five sections. The following section situates the debate on the role of data in the development of public policies addressing disaster-induced displacement. The third section presents the methodological approach, while the fourth section describes the databases analyzed, followed by the discussion and concluding remarks.

DATA, DISASTERS, AND PUBLIC POLICY: CHALLENGES IN MEASURING DISPLACEMENT

In Brazil, estimates indicate that approximately 8.27 million people live in areas exposed to natural disaster risks, such as landslides and floods (IBGE; CEMADEN, 2018). Within this context, growing concern has emerged regarding the social impacts of such events, particularly with respect to population exposure and vulnerability, as well as the response capacity of affected groups (Valencio et al., 2009; Almeida, 2011; Barbieri et al., 2022). Thus, adaptive strategies, including mobility, are frequently observed as mechanisms to reduce the social and economic vulnerability of households (Alvalá; Barbieri, 2017; Barbieri et al., 2022; Correia, 2024).

In disasters caused by anthropogenic, technological, or environmental factors, population displacement represents one of the primary impacts experienced in affected areas. Such displacement generally occurs over short distances and is driven by the coercive nature of the event itself (Black et al., 2011; Reed; Ludwig; Braslow, 2016). Population movements may occur both proactively, based on risk perception, and abruptly following extreme events, often in the form of evacuations or relocations (Hugo, 2011; Barbieri et al., 2022; Moreira, 2023; Moreira, 2024).

The availability of economic, social, and political resources determines the ability of affected populations to leave impacted areas (Black et al., 2011). In this regard, concepts such as risk, vulnerability, and danger are essential for analyzing the displacement process beyond the disaster event itself, considering the physical and social environments surrounding the most vulnerable populations, particularly in the design and implementation of public policies (Almeida, 2011). Groups with more limited access to resources, influenced by factors such as race/ethnicity, educational attainment, age, gender, and income, tend to be more vulnerable, thereby amplifying the impacts of adverse events

COMPARATIVE ANALYSIS OF DATA SOURCES FOR MEASURING DISASTER-RELATED DISPLACEMENT IN BRAZIL

(Muttarak et al., 2016; Barbieri et al., 2022). Understanding these processes requires systematic data capable of capturing both the characteristics of affected populations and the territorial contexts in which disasters occur. Databases on environmental and anthropogenic disasters are widely used by public and private institutions, particularly in contexts where they provide evidence to support evidence-based public policies (EBPP) (Wirtz et al., 2014; Kuhn et al., 2022). Such databases must maintain high standards of quality, with transparent data collection methods and consistent, standardized concepts, especially regarding disaster-induced displacement, where definitions and terminology often vary across pre and post-disaster contexts (Oliver-Smith, 2018; Kuhn et al., 2022).

In Brazil, there has been a growing availability of datasets from diverse sources, including census surveys, geospatial databases, and administrative information systems. Nevertheless, the production of robust evidence on disaster-induced displacement continues to face important limitations, including insufficient territorial and sociodemographic disaggregation, institutional fragmentation, and the lack of integration among available data sources. These limitations reduce the analytical potential of the available information and hinder the measurement and characterization of displacement, thereby compromising its use in the formulation and implementation of public policies. In this context, data-driven approaches have become increasingly relevant for identifying patterns of vulnerability, anticipating risks, and supporting more effective institutional responses. Therefore, a comparative assessment of these databases is essential to understand their strengths and limitations in measuring displacement and supporting evidence-based public policymaking.

METHODOLOGICAL APPROACH

This article compares data sources used in Brazil to measure and characterize disaster-induced displacement, assessing their potential to support monitoring activities and inform public policymaking. For this purpose, six databases providing estimates of the number of people affected by different types of disasters were selected through an exploratory non-exhaustive approach. The selection also considered accessibility and usability criteria, prioritizing publicly available data sources that allow direct access and extraction without requiring institutional authorization. Preference was given to databases offering structured query interfaces, including visualizations such as maps and graphs, to reflect the actual context in which these data are used by public managers, researchers, and other stakeholders. In addition, the selected databases provide at least a minimum level of methodological documentation to support data interpretation. This criterion is justified by the article's objective of evaluating not only the existence of information, but also its practical potential for monitoring and informing public policy. The analysis does not distinguish among disaster types, as its primary focus is the potential for measuring displacement. It is important to emphasize that the analysis is exploratory rather than exhaustive and is limited to publicly available and easily accessible databases. Therefore, the findings should be interpreted as a comparative assessment of widely available data sources used by researchers and policymakers, rather than as a comprehensive inventory of all existing initiatives for disaster and displacement data production in Brazil.

The selection considered the analytical potential of each database either to measure displacement directly or to allow its inference from other available information. Direct measurement refers to databases that explicitly report the number of displaced people, whereas indirect measurement refers to databases from which displacement can be inferred through variables such as displaced people without shelter (*desalojados*), sheltered people (*desabrigados*), or populations exposed to disaster risk, which are treated as proxy variables, i.e., substitute measures for displacement. Methodologically, the definitions of these concepts are based on the terminology adopted by Brazilian National Policy on Protection and Civil Defense under Brazilian Law No. 12,608 of 2012. According to the law, a *desabrigado* is an individual who is permanently or temporarily forced to leave their residence due to a disaster and requires shelter provided through the National System for Protection and Civil Defense (SINPDEC). A *desalojado* is an individual who is permanently or temporarily forced to leave their residence due to a disaster but does not require shelter (Brasil, 2012). In contrast, displaced people comprise all individuals who are forced to leave their homes due to threats arising from environmental disasters, anthropogenic disasters, or armed conflicts (United Nations, 1998).

Following the description of the data sources, they were compared according to five indicators: (i) capacity to measure displacement; (ii) level of sociodemographic disaggregation; (iii) territorial scale of data availability; (iv) methodological consistency; and (v) potential for supporting public policymaking. These indicators are described in greater detail in Chart 1.

INDICATOR	ANALYZED DIMENSION
Capacity to measure displacement	Direct: displacement explicitly recorded / Indirect: presence of proxy variables for displacement, such as sheltered (<i>desabrigados</i>) or non-sheltered displaced people (<i>desalojados</i>) / Inferred: displacement deduced from the overall impact of the disaster.
Level of sociodemographic disaggregation	Availability of sociodemographic variables that enable the identification of characteristics of the affected population, such as gender, age, income, and household composition.
Territorial scale of availability	Territorial scale at which the data are made available, including national, regional, state, municipal, or sub-municipal levels.
Methodological consistency	Clarity of the definitions employed, methodological transparency, and the possibility of comparing estimates with different data sources.
Potential use for public policymaking	Database potential to support public policymaking, including the identification of vulnerable populations, the territorial targeting of interventions, and the monitoring of displacement.

Chart 1 - Analytical dimensions used to evaluate the databases. Source: Author's own elaboration.

The analysis is qualitative and comparative in nature, focusing on the evaluation of the characteristics and potential of the selected data sources. The unit of analysis consists of the databases themselves. As an exploratory study, the analysis does not aim to provide an exhaustive assessment of all available datasets. It rather offers a comparative overview of relevant data sources. Consequently, other databases produced by government agencies, research institutions, or civil society organizations may contain relevant information that is not included in this analysis. Prioritizing widely accessible data sources was intended to align the discussion with the tools that are effectively available to support research and evidence-informed public policymaking.

CHARACTERIZATION OF THE ANALYZED DATA SOURCES

In Brazil, several initiatives have been developed to expand the availability of disaster-related information. One of the most prominent is the Population in Risk Areas database, released by the National Center for Monitoring and Alerts for Natural Disasters (CEMADEN) in partnership with the Brazilian Institute of Geography and Statistics (IBGE), based on data from the 2010 Population Census. The database is built upon a specific spatial framework known as the Statistical Territorial Base of Risk Areas (BATER), which integrates census tract data from the 2010 Census with mapped landslide, flood, and flash flood risk areas to estimate the population exposed to disaster risk in Brazil (IBGE; CEMADEN, 2018; Assis Dias et al., 2018; Saito et al., 2019). It includes demographic, socioeconomic, and housing infrastructure information for populations living in risk areas, encompassing indicators of household composition, housing conditions, and access to basic services, thereby enabling the identification of socio-environmental vulnerabilities. Despite its high level of sociodemographic detail, the database does not allow for the direct measurement of disaster-induced displacement.

Another important source is the Brazilian Integrated Disaster Information System (S2iD), maintained by the Ministry of Regional Development since 2012. The system records disaster events, monitors financial transfers, recognizes states of emergency and public calamity, and consolidates official information from the National Secretariat of Civil Defense (SEDEC) regarding disaster risk management (Brasil, 2026). The database includes information on location (municipality and geographic

COMPARATIVE ANALYSIS OF DATA SOURCES FOR MEASURING DISASTER-RELATED DISPLACEMENT IN BRAZIL

coordinates), disaster type according to the Brazilian Classification and Coding of Disasters (Cobrade), year of occurrence, and recognition status, as well as administrative information (decree number and date, publication in the *Diário Oficial da União*, and processes). Although S2iD provides extensive institutional coverage, it presents limitations regarding the standardization of information on affected populations.

The Digital Atlas of Disasters in Brazil compiles information on disaster impacts since 1991 and allows interactive queries at both the municipal and state levels. It includes data on fatalities, non-sheltered displaced people (*desalojados*), sheltered people (*desabrigados*), injured and ill individuals, and the total number of directly affected people, in addition to estimates of public and private material and financial losses by sector and category (Brasil, 2023). The platform also provides an interactive map that enables users to visualize disasters and the number of affected people by region (MIDR, 2026).

The Geological Survey of Brazil (SGB) also provides information related to territorial risk management through its online portal (SGB, 2026). For selected municipalities, risk-area assessments characterize specific sectors based on local information, including address, disaster typology, the number of buildings and residents, and levels of risk and vulnerability. In addition, technical reports include recommendations for interventions aimed at reducing disaster risk.

Two international datasets also provide information on Brazil for estimating disaster-induced displacement: International Displacement Monitoring Centre (IDMC), and Emergency Events Database (EM-DAT).

The IDMC database provides information on internal displacement caused by conflicts and disasters, that is, displacement occurring within the national borders of the affected country. For Brazil, data are available from 2008 onward and originate from the National Secretariat of Civil Defense (SEDEC), which also supplies information to the Brazilian Integrated Disaster Information System (S2iD) maintained by the Ministry of Integration and Regional Development (IDMC, 2026). The database includes information on hydrological, geological, and climatological disasters. It distinguishes between internal displacements, referring to displacement movements triggered by disaster events, and internally displaced people, referring to individuals who were forced to leave their place of residence because of a disaster. The datasets can be downloaded as spreadsheets (xls) format and are organized by disaster event, including the year of occurrence, location (described in text and potentially identifying municipalities, states, or regions), the estimated number of displacements, the disaster category and type, and a brief event description. Unlike Brazilian national databases, the IDMC reports direct estimates of disaster-induced displacement.

The Emergency Events Database (EM-DAT) records global data on disasters and their human and social impacts and is maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at the Catholic University of Louvain, Belgium. The database is freely available and provides information on natural and technological disasters dating back to the 1900s (Delforge et al., 2023; CRED, 2026). In the EM-DAT database, human impact is described using five main indicators: (1) deaths, (2) injuries, (3) affected people, (4) displaced people, and (5) an aggregated measure of total impact. In some cases, population estimates are derived from indirect information, such as the number of affected households, using multipliers based on average household size. These indicators are intended to provide a consolidated measure of the overall human impact of disasters, enabling comparisons across events and regions.

Overall, the datasets analyzed exhibit important complementarities but also significant limitations. While some provide a high level of sociodemographic and territorial disaggregation, others allow the direct measurement of displacement. However, the fragmentation of information hinders the development of consistent estimates, highlighting the challenges associated with the integrated use of these databases for disaster monitoring and public policy formulation. The differences observed, particularly regarding the capacity to measure displacement, the level of information disaggregation, and the territorial scale are examined comparatively in the following section.

POTENTIAL AND LIMITATIONS OF DATASETS FOR ANALYZING DISASTER-INDUCED DISPLACEMENT

According to the indicators established in the methodology section, each dataset was analyzed across five dimensions: (I) capacity to measure displacement; (II) level of sociodemographic disaggregation of the information; (III) territorial scale at which the data are available; (IV) methodological consistency; and (V) potential for use in public policies aimed at assisting environmentally displaced populations.

The Population in Risk Areas in Brazil database compiles information on residents living in areas classified as being at risk, with data available at both the household and individual levels. These data make it possible to estimate the potential number of displaced people in the event of disasters by considering the population living in areas most susceptible to hazardous events. Regarding Indicator II (level of sociodemographic disaggregation), the database provides information disaggregated by variables such as age, income, gender, and the gender of the household head, enabling analyses of social vulnerability and the differential likelihood of displacement among distinct demographic groups. With respect to Indicator III (territorial scale of data availability), the data are provided at sub-municipal geographic units, allowing analyses at a finer territorial scale and facilitating subsequent aggregation to municipal or regional levels. Regarding the methodological consistency indicator, the estimates and definitions used in its construction are described in the documentation that accompanies the report, with clear definitions and standardized spatial and demographic variables. Finally, regarding Indicator V (potential for public policy use), the database offers substantial analytical value, particularly because of its high level of territorial and sociodemographic disaggregation. Characterizing the population residing in risk areas constitutes an important step in designing policies aimed at reducing vulnerability and planning institutional responses to disasters. Although the database does not directly record population displacement, it allows inferences about potential displacement based on the identification of populations exposed to risk and through comparison with other data sources that record affected people, displaced people without shelter (*desalojados*) or sheltered people (*desabrigados*). Unlike data sources that only document impacts after a disaster has occurred, this database enables the prior identification of potentially exposed populations, thereby expanding opportunities for planning and prevention. In this sense, even though it does not record actual displacement, the analysis of this population before disaster occurrence, focusing on those potentially exposed, supports the development of preventive policies based on the territorial identification of populations at risk. Its main limitation is its temporal lag, as it is based on data from the 2010 Population Census.

The databases derived from the Brazilian Integrated Disaster Information System (S2iD) and the Digital Atlas of Disasters in Brazil are closely integrated, with S2iD serving as the primary data source for the Atlas. Both allow the indirect estimation of disaster-induced displacement through records of displaced people without shelter (*desalojados*) or sheltered people (*desabrigados*). However, they lack sociodemographic disaggregation, limiting more detailed analyses of the characteristics of affected populations. Data are made available predominantly at the municipal level and exhibit intermediate methodological consistency, as they depend on the completion of administrative forms by local authorities, which may result in heterogeneity and the absence of systematic data updates (Brasil, 2022). In addition, the possibility of duplicate records, particularly for slow-onset disasters such as droughts and prolonged dry spells, may compromise the accuracy of the estimates (Brasil, 2022). This limitation restricts the identification of the population groups most affected by disasters, thereby hindering the targeting of public policies toward particularly vulnerable populations. Collectively, these constraints reduce the databases' analytical potential for more refined public policy design, although they remain valuable for monitoring disaster impacts on national scale.

The database produced by the Geological Survey of Brazil (SGB) exhibits high methodological consistency and high spatial resolution, with sub-municipal level data that allow the identification of risk areas with considerable precision. Similar to the Population in Risk Areas database, it does not measure displacement directly but enables inferences regarding populations potentially exposed to disaster risk. Indicator IV (Methodological Consistency) was classified as high, reflecting the detailed technical and spatial information available on exposed areas, including the specific types of risks to which populations are exposed. Consequently, Indicator V (Potential for Public Policymaking) was also classified as high,

COMPARATIVE ANALYSIS OF DATA SOURCES FOR MEASURING DISASTER-RELATED DISPLACEMENT IN BRAZIL

particularly in the context of pre-disaster (ex ante) policies. By spatially identifying areas of greater exposure and the populations potentially affected, the database supports the development of preventive measures aimed at reducing vulnerability and informing urban planning initiatives.

The Internal Displacement Monitoring Centre (IDMC) database provides a direct measure of disaster-induced displacement, as it reports both the number of internally displaced people and the number of displacement movements associated with recorded disaster events. However, it does not provide sociodemographic information, limiting more detailed analyses of the characteristics of affected populations. Disaster events are recorded according to their geographic location and may be delimited by municipal boundaries (in most cases) or by broader territorial units, particularly in large-scale disasters or where spatial boundaries are imprecisely defined. Indicator IV (Methodological Consistency) was classified as high, as the procedures for data collection, systematization, and updating are clearly documented. The information is derived primarily from secondary sources, including administrative records from national institutions such as the National Secretariat of Civil Defense (SEDEC), under the Ministry of Integration and Regional Development. Records are continuously reviewed and updated, considering events occurring within 180 days following the disaster (IDMC, 2026). Despite its ability to directly measure displacement, Indicator V (Potential for use in public policies) was classified as low, since the database primarily documents displacement that has already occurred, limiting its usefulness for preventive risk reduction strategies.

Similarly, the Emergency Events Database (EM-DAT) allows the inference of potential displacement through variables reporting the number of sheltered and non-sheltered displaced people, which reflect housing loss or damage resulting from disasters. As with the S2iD and the Digital Atlas of Disasters databases, sociodemographic disaggregation is unavailable, since only aggregated counts of affected people are reported. Data are provided at the national or subnational level and may include administrative units such as states or municipalities, depending on data availability. Indicator IV (Methodological Consistency) was classified as high, considering that the database compiles information from multiple national and international sources and applies systematic procedures for data verification, coding, and standardization to produce a relational database structured according to event identification, disaster typology, and the measurement of social and economic impacts. As with the IDMC, its primary application is post-disaster impact monitoring, with more limited usefulness for disaster anticipation and prevention strategies. A comparative summary of the databases analyzed is presented in Chart 2.

Indicator Database	I) Capacity to Measure Displacement	II) Level of Sociodemographic Disaggregation	III) Territorial Scale of Data Availability	IV) Methodological Consistency	V) Potential for Use in Public Policies
Population in Risk Areas	Inferred	Disaggregated by age groups, income, gender, and gender of the head of household	Sub-municipal	High	High
S2iD	Indirect	Not available	Municipal	Moderate	Moderate
Digital Atlas of Disasters in Brazil	Indirect	Not available	Municipal	Moderate	Moderate
Geological Survey of Brazil (SGB)	Inferred	Not available	Sub-municipal	High	High
Internal Displacement Monitoring Centre (IDMC)	Direct	Not available	Municipal/Regional	High	Low
Emergency Events Database (EM-DAT)	Indirect	Not available	Municipal	High	Low

Chart 2 – Comparative assessment of disaster databases. Source: Author's own elaboration.

While the Population in Risk Areas and Geological Survey of Brazil (SGB) databases make it possible to identify populations potentially exposed to hazardous events in advance, other databases record the impacts observed after disasters occur, such as S2iD, the Digital Atlas of Disasters in Brazil, EM-DAT, and IDMC. In this regard, the databases classified in the first group can support prevention, planning, vulnerability reduction, and disaster risk reduction preparedness, whereas those in the second group provide the basis for ex-post actions, including emergency response, assistance to affected populations, reconstruction, and impact assessment. It should be noted that ex-ante policies can also reduce displacement before it occurs by guiding targeted interventions in risk areas, such as slope stabilization works, land-use zoning, and urban drainage projects.

In addition to this distinction, the databases can also be organized around three main dimensions: (i) risk exposure, by identifying populations exposed to risks and supporting preventive policies and territorial planning; (ii) disaster impacts, through impact monitoring and indirect estimates of displacement; and (iii) actual displacement, enabling the direct analysis of forced mobility and the assessment of the responses required to address disasters. These differences imply distinct applications for public policymaking, ranging from prevention and preparedness to emergency response and reconstruction.

Based on the findings, several priorities can be identified for improving the production of information on disaster-induced displacement in Brazil. First, greater integration is recommended between databases focused on risk exposure and those recording disaster impacts, allowing the sociodemographic characteristics of exposed populations to be linked with observed post-disaster displacement and the spatial information associated with these events. Second, the adoption of a standardized minimum set of variables across information systems is recommended, including the geographic location of the event, date of occurrence, displaced people without shelter (desalojados) or sheltered people (desabrigados), gender, age, and basic socioeconomic characteristics of the affected population. Furthermore, data integration should, whenever possible, be carried out at the municipal or sub-municipal level to improve the identification of vulnerable populations and support territorially targeted public policies. Strengthening interoperability between national and international databases can contribute to more robust assessments and to the improvement of prevention, response, and recovery strategies related to disaster-induced displacement.

CONCLUSIONS

The analysis showed that, despite the wide availability of disaster databases in Brazil and internationally, structural limitations persist that hinder the production of robust evidence on population displacement. The most significant challenges include the sociodemographic disaggregation in parts of the data of many datasets, methodological heterogeneity, and institutional fragmentation, all of which reduce the comparability and analytical potential of the available information.

The findings indicate that national databases tend to provide greater territorial detail and greater potential for identifying populations exposed to hazards, although they are limited in directly measuring displacement. In contrast, international databases prioritize the recording of disaster impacts and actual displacement, although with lower levels of sociodemographic and spatial disaggregation. This distinction highlights the existence of complementary approaches associated, respectively, with ex-ante and ex-post analytical strategies.

This article demonstrates that disaster databases can be understood through three analytical dimensions: risk exposure, impact, and displacement, whose combinations determine their different potential applications in public policy. This typology increases the understanding of existing gaps and the possibilities for integrating different information systems. The results indicate that improving the measurement of disaster-induced displacement depends not only on expanding data availability but, most of all, on efforts toward conceptual standardization, institutional integration, and the incorporation of greater sociodemographic and spatial disaggregation. It also becomes evident that the main limitation of the databases analyzed lies not only in the absence of certain types of information, but also in the limited interoperability among existing systems. Although these databases produce complementary information on risk exposure, disaster impacts, and displacement, the lack of integration hinders the

COMPARATIVE ANALYSIS OF DATA SOURCES FOR MEASURING DISASTER-RELATED DISPLACEMENT IN BRAZIL

development of more comprehensive assessments of disaster-induced displacement processes across the national territory.

In this regard, strengthening interoperability among different platforms could be achieved through four main strategies. First, the adoption of standardized territorial identifiers, such as official geographic codes for municipalities and census tracts available in the Brazilian Institute of Geography and Statistics (IBGE) census data, would facilitate the integration of information on exposure, impacts, and displacement. Second, the development of shared minimum metadata standards, including clear definitions of variables, units of measurement, reference periods, and data update procedures, would improve consistency across datasets. Third, the conceptual harmonization of the terminology used to describe affected populations is needed, particularly for categories such as displaced people without shelter (*desalojados*) or sheltered people (*desabrigados*), which are often defined differently across institutions. Finally, the standardization of the temporal framework of data collection is recommended to enable longitudinal monitoring of disaster impacts and displacement over time.

Overall, the integration of databases with different analytical focuses is essential for producing more comprehensive evidence and strengthening evidence-based public policies.

ACKNOWLEDGMENTS

Not applicable.

DATA AVAILABILITY

Not applicable.

REFERENCES

ALMEIDA, Lutiane Queiroz de. Por uma ciência dos riscos e vulnerabilidades na geografia (a science of the risks and vulnerabilities to geography). Mercator, Fortaleza, v. 10, n. 23, p. 83 a 99, nov. 2011. ISSN 1984-2201. Available at: . Accessed: feb. 9, 2026.

ALVALÁ, R.; BARBIERI, A. Desastres Naturais. In: NOBRE, C; MARENGO, J. Mudanças Climáticas em Rede: um olhar interdisciplinar. Contribuições do Instituto Nacional de Ciência e Tecnologia para Mudanças Climáticas (p. 608). Bauru: Canal 6 Editora, 2017.

ASSIS DIAS, M. C.; SAITO, S. M.; DOS SANTOS ALVALÁ, R. C.; STENNER, C.; PINHO, G.; NOBRE, C. A.; LIMA, C. O. Estimation of exposed population to landslides and floods risk areas in Brazil, on an intra-urban scale. International Journal of Disaster Risk Reduction, 31, 449-459. 2018. DOI: <https://doi.org/10.1016/j.ijdrr.2018.06.002>

BARBIERI, A.; DE MATTOS VIANA, R.; CAMPOS DE OLIVEIRA SOARES, V.; ALINE SCHNEIDER, R. Contribuições teóricas para uma demografia dos desastres no Brasil. Revista Brasileira de Estudos de População, [S. l.], v. 39, p. 1–29, 2022. DOI: 10.20947/S0102-3098a0227. Available at: <https://rebep.org.br/revista/article/view/2057>. Accessed: nov. 19, 2025.

BLACK, R; ADGER, W; ARNELL, N; DERCON, S. GEDDES; A. THOMAS, D. The effect of environmental change on human migration. Global Environmental Change 21:S3-S11, 2011.

BRASIL. Lei nº 12.608, de 10 de abril de 2012. Institui a Política Nacional de Proteção e Defesa Civil (PNPDEC); dispõe sobre o Sistema Nacional de Proteção e Defesa Civil (SINPDEC) e o Conselho Nacional de Proteção e Defesa Civil (CONPDEC); autoriza a criação de sistema de informações e monitoramento de desastres; e dá outras providências. Diário Oficial da União: seção 1, Brasília, DF, 11 abr. 2012. Available at: Planalto – Lei nº 12.608/2012. Available at: https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12608.htm . Accessed: jun. 18, 2026.

BRASIL. Ministério da Integração e do Desenvolvimento Regional. Secretaria Nacional de Proteção e

Defesa Civil. Sistema Integrado de Informações sobre Desastres (S2iD). Brasília: MIDR, [s.d.]. Available at: <https://s2id.mi.gov.br/>. Accessed: jun. 18, 2026.

BRASIL. Ministério da Integração e do Desenvolvimento Regional. Secretaria de Proteção e Defesa Civil. Universidade Federal de Santa Catarina. Centro de Estudos e Pesquisas em Engenharia e Defesa Civil. Base de dados do Atlas Digital de Desastres no Brasil: manual de aplicação. Brasília: MIDR, 2022.

BRASIL. Ministério da Integração e do Desenvolvimento Regional. Secretaria Nacional de Proteção e Defesa Civil; Universidade Federal de Santa Catarina. Centro de Estudos e Pesquisas em Engenharia e Defesa Civil. Atlas digital de desastres no Brasil. Brasília: MIDR, 2023. Available at: <https://atlasdigital.mdr.gov.br/>. Accessed: dec. 19, 2026.

CENTRE FOR RESEARCH ON THE EPIDEMIOLOGY OF DISASTERS (CRED). Emergency Events Database (EM-DAT). Louvain-la-Neuve: Université catholique de Louvain, [s.d.]. Available at: <https://www.emdat.be/>. Accessed: jun. 18, 2026.

CORREIA, Isac Alves. Environmental migration, (im)mobility, and adaptation to droughts in the Seridó Potiguar. *Sustainability in Debate*, [S. l.], v. 15, n. 3, p. 229–259, 2024. DOI: 10.18472/SustDeb.v15n3.2024.55532. Available at: <https://periodicos.unb.br/index.php/sust/article/view/55532>. Accessed: mar. 9, 2026.

DELFORGE, Damien; WATHELET, Valentin; BELOW, Regina; SOFIA, Cinzia; TONNELIER, Margo; VAN LOENHOUT, Joris; SPEYBROECK, Niko. EM-DAT: the Emergency Events Database. 2023. DOI: <https://doi.org/10.21203/rs.3.rs-3807553/v1>. Available at: <https://www.sciencedirect.com/science/article/pii/S2212420925003334>. Accessed: jan. 29, 2026.

ESTADO DE MINAS. Chega a 47 número de mortes por chuvas em Minas Gerais. 20 jan. 2020. Available at: https://www.em.com.br/app/noticia/gerais/2020/01/27/interna_gerais,1117418/chega-a-47-numero-de-mortes-por-chuvas-em-minas-gerais.shtml. Accessed: jan. 19, 2026.

HUGO, G. Future Demographic Change and Its Interactions with Migration and Climate Change. *Global Environmental Change*, 21, S21-S33, 2011. Available at: <https://doi.org/10.1016/j.gloenvcha.2011.09.008>

IBGE e Cemaden. População em áreas de risco no Brasil. 2018. Available at: . Accessed: dez. 19, 2025.

INTERNAL DISPLACEMENT MONITORING CENTRE (IDMC). Country Profile - Brazil. 2026. Available at: <https://www.internal-displacement.org/countries/brazil/>. Accessed: mar. 09, 2026.

IPCC. Summary for policymakers. In: LEE, H.; ROMERO, J. (ed.). *Climate change 2023: synthesis report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: IPCC, 2023. p. 1–34. DOI: <https://doi.org/10.59327/IPCC/AR6-9789291691647.001>. Available at: . Accessed: jan. 29, 2026.

KUHN, C. E. S., REIS, F. A. G. V., OLIVEIRA, V. G. D., CABRAL, V. C., GABELINI, B. M., & VELOSO, V. Q. Evolution of public policies on natural disasters in brazil and worldwide. *Anais da Academia Brasileira de Ciências*, v. 94, p. e20210869, 2022.

MINISTÉRIO DA INTEGRAÇÃO E DO DESENVOLVIMENTO REGIONAL (MIDR). Atlas Digital de Desastres no Brasil. Brasília: MIDR, [s.d.]. Available at: <https://atlasdigital.mdr.gov.br/>. Accessed: jun. 18, 2026.

MOREIRA, Richard Eustáquio de Assis. Deslocamentos induzidos por desastres relacionados à chuva no Brasil entre 2013 e 2022. *REMHU, Revista Interdisciplinar da Mobilidade Humana*, [S. l.], v. 32, p. e321876, 2024. DOI: 10.1590/1980-858525038800032206. Available at: <https://remhu.csem.org.br/index.php/remhu/article/view/1876>. Accessed: jan. 09, 2026.

MOREIRA, Richard Eustáquio de Assis. Vulnerabilidades e Heterogeneidades Populacionais em um Contexto de Realocação Planejada em Belo Horizonte. 2023. Tese (Doutorado) - Universidade Federal

COMPARATIVE ANALYSIS OF DATA SOURCES FOR MEASURING DISASTER-RELATED DISPLACEMENT IN BRAZIL

de Minas Gerais, Centro de Desenvolvimento e Planejamento Regional, Belo Horizonte, 2023.

MUTTARAK, R; LUTZ, W; JIANG, L. What can demographers contribute to the study of vulnerability? In Muttarak, R. & Jiang, L. (Eds.). *Demographic Differential Vulnerability to Climate-Related Disasters*. Vienna Yearbook of Population Research, 13. Vienna: Austrian Academy of Sciences Press, 2016.

OLIVER-SMITH, Anthony. Disasters and large-scale population dislocations: international and national responses. *Oxford Research Encyclopedia of Natural Hazard Science*, 2018. Available at: https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/EGM2019_displacement.pdf. Accessed: nov. 9, 2025.

REED, H; LUDWIG, B; BRASLOW, L. Forced Migration. In: White, M. (ed). *International Handbook of Migration and Population Distribution*. Netherlands: Springer, 2016. p. 605 – 625.

RIO GRANDE DO SUL. Defesa Civil. Defesa Civil atualiza balanço das enchentes no RS (10/6, 9h). Porto Alegre: Governo do Estado do Rio Grande do Sul, 2024. Available at: <https://www.defesacivil.rs.gov.br/defesa-civil-atualiza-balanco-das-enchentes-no-rs-10-6-9h-6671eb9e34066-6679e4a1759fd>. Accessed: jan. 19, 2026.

SAITO, S. M., DIAS, M. C. de A., ALVALÁ, R. C. dos S., STENNER, C., FRANCO, C. de O., RIBEIRO, J. V. M., SOUZA, P. A. de., & SANTANA, R. A. Urban population exposed to risks of landslides, floods and flash floods in Brazil. *Sociedade & Natureza*, v. 31, p. e46320, 2019.

SERVIÇO GEOLÓGICO DO BRASIL (SGB). GeoSGB. Brasília: Serviço Geológico do Brasil, [s.d.]. Available at: <https://geoportal.sgb.gov.br/geosgb/>. Accessed: jun. 18, 2026.

UNITED NATIONS. Guiding Principles on Internal Displacement. New York: United Nations General Assembly, 1998. (U.N. Doc. E/CN.4/1998/53/Add.2). Available at: <https://docs.un.org/en/e/cn.4/1998/53/add.2>. Accessed: jun. 18, 2026.

VALENCIO, N., SIENA, M., MARCHEZINI, V., GONÇALVES J. (org.). *Sociologia dos desastres: construção, interfaces e perspectivas no Brasil*. São Carlos: RiMA Ed., 2009. 280p. Available at: <https://defesacivil.es.gov.br/Media/DefesaCivil/Publicacoes/Outros/Livro-Sociologia-Dos-Desastres.pdf>. Accessed: jan. 29, de 2026.

WIRTZ, A.; KRON, W.; LÖW, P.; STEUER, M. The need for data: natural disasters and the challenges of database management. *Natural Hazards*, v. 70, p. 135–157, 2014. DOI: <https://doi.org/10.1007/s11069-012-0312-4>. Accessed: feb. 9, 2026.

Author's Affiliation

Moreira, R.E.A. - Researcher at the Center for Development and Regional Planning , Belo Horizonte (MG), Brasil.

Authors' Contribution

Moreira, R.E.A. - The author contributed to the elaboration, realization and manipulation of the data and writing.

Editors in Charge

Alexandre Queiroz Pereira Eduardo Von Dentz

Conflict of Interest

The authors declare that there is no conflict of interest.

Research Data Availability

All the data supporting the results of this study were published in the article itself.

Use of AI

No Artificial Intelligence tools were used.

This preprint was submitted under the following conditions:

- The authors declare that the necessary Terms of Free and Informed Consent of participants or patients in the research were obtained and are described in the manuscript, when applicable.
- The authors declare that the preparation of the manuscript followed the ethical norms of scientific communication.
- The authors declare that they are aware that they are solely responsible for the content of the preprint and that the deposit in SciELO Preprints does not mean any commitment on the part of SciELO, except its preservation and dissemination.
- The authors declare that the data, applications, and other content underlying the manuscript are referenced.
- The deposited manuscript is in PDF format.
- The authors declare that the research that originated the manuscript followed good ethical practices and that the necessary approvals from research ethics committees, when applicable, are described in the manuscript.
- The authors declare that once a manuscript is posted on the SciELO Preprints server, it can only be taken down on request to the SciELO Preprints server Editorial Secretariat, who will post a retraction notice in its place.
- The authors agree that the approved manuscript will be made available under a [Creative Commons CC-BY](#) license.
- The submitting author declares that the contributions of all authors and conflict of interest statement are included explicitly and in specific sections of the manuscript.
- The authors declare that the manuscript was not deposited and/or previously made available on another preprint server or published by a journal.
- If the manuscript is being reviewed or being prepared for publishing but not yet published by a journal, the authors declare that they have received authorization from the journal to make this deposit.
- The submitting author declares that all authors of the manuscript agree with the submission to SciELO Preprints.