UCLouvain
CRED Centre for Research on the Epidemiology of Disasters

Hydrological Disasters in South America

USAID FROM THE AMERICAN PEOPLE

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Following the catastrophic flooding (as of July 2024: 181 deaths, 32 missing and over 2.3 million people affected) in Rio Grande do Sul, Brazil, in late April 2024, hydrological disasters[1] within the South American region have garnered additional attention. Flooding and related hydrological hazards are the most common types of disasters observed globally in EM-DAT, causing significant damage to property and people. Understanding their impact is increasingly important as policymakers seek to manage disaster risk. This CRED Crunch presents a cursory overview of flooding trends and notable events over the previous two decades in South America.

Hydrological hazards are the most prevalent subgroup of natural hazards in South America and are associated with the highest number of deaths in the region. Floods comprise the majority of these hydrological hazards, although rainfall-induced mass movements also pose significant threats.

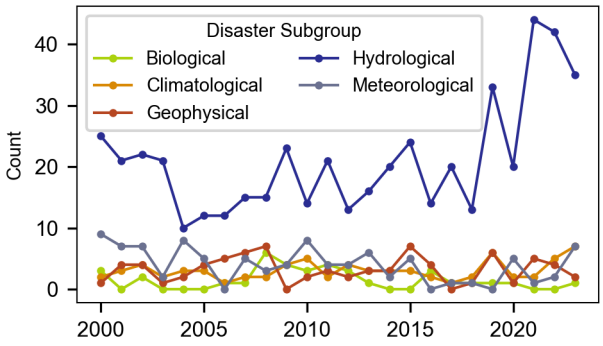

Fig. 1. Evolution of the Number of Disasters in South America Recorded in EM-DAT from 2000 to 2023.

In recent years, the frequency of hydrological disasters in South America seems to have increased, relative to other types of disasters (Fig. 1).

Most Impactful Events

Brazil, Colombia, and Peru experience the largest number of hydrological disasters within the South American region (Fig. 2). Nine of the ten deadliest hydrological disasters in South America occurred within these three countries (Table 1). The deadliest hydrological event recorded in EM-DAT occurred in the state of Rio de Janeiro in Brazil, on January 11th, 2011.

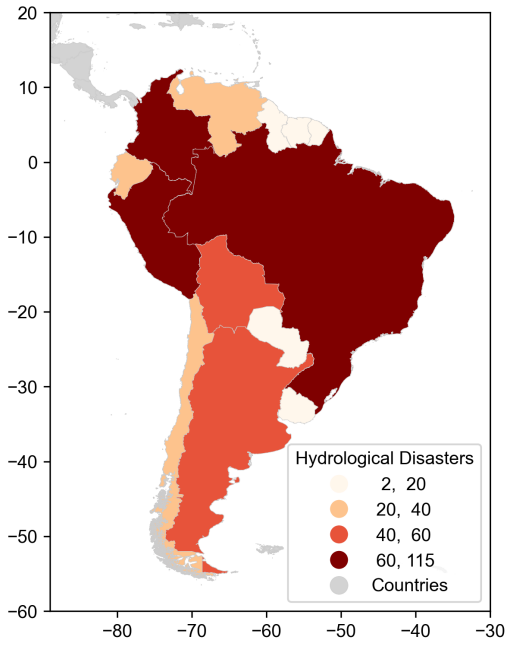

Fig. 2. Hydrological Disasters Occurrence in South America, per Country (2000 - 2023)

Table 1. Top 10 Hydrological Disasters in South America by Mortality between 2000 and 2023

Country	Disaster Subtype	Date	Total Deaths	Total Affected	Total Damage, Adjusted ('000 US$)
Brazil (Rio de Janeiro)	Riverine Flood	11 Jan 2011	900	45,000	1,354,596
Colombia	Riverine Flood	Apr 2010 to Mar 2011	418	2,791,999	1,397,359
Colombia (Putumayo)	Mudslide	31 Mar 2017	329	45,360	124,307
Brazil (Rio de Janeiro)	Flood	13 - 16 Feb 2022	272	16,083	28,111
Brazil (Rio de Janeiro)	Riverine Flood	04 - 12 Apr 2010	256	74,938	279,472
Peru	Flood	15 - 19 Mar 2017	184	1,800,505	3,853,527
Chile	Flash Flood	25 Mar - 8 Apr 2015	178	193,881	1,928,354
Brazil	Riverine Flood	Dec 2003 - Feb 2004	161	175,470	501,878
Peru	Riverine Flood	Dec 2009 - Mar 2010	158	236,308	No Data
Brazil (Santa Catarina)	Riverine Flood	22 - 24 Nov 2008	151	1,500,015	1,061,420

[1] In this report, hydrological disaster are defined as within the EM-DAT classification glossary: https://doc.emdat.be/docs/data-structure-and-content/glossary/hydrological-hazards/.

[2] International Federation of Red Cross and Red Crescent Societies (IFRC). "Brazil Floods." Report, January 18, 2011. https://www.ifrc.org/docs/appeals/11/MDRBR006do.pdf.

Within 24 hours, a series of floods and ensuing mudslides killed at least 900 people and caused widespread destruction, which cut electricity, phone lines, and running water to thousands of inhabitants.[2] In contrast to the sudden nature of Brazil's deadliest flood, Colombia's most fatal event over the last 20 years lasted multiple months across 2010 and 2011, when an intense rainy season affected most of the country and millions of its inhabitants.[3] These two events illustrate the variety of hydrological disasters at both geographic and time scales.

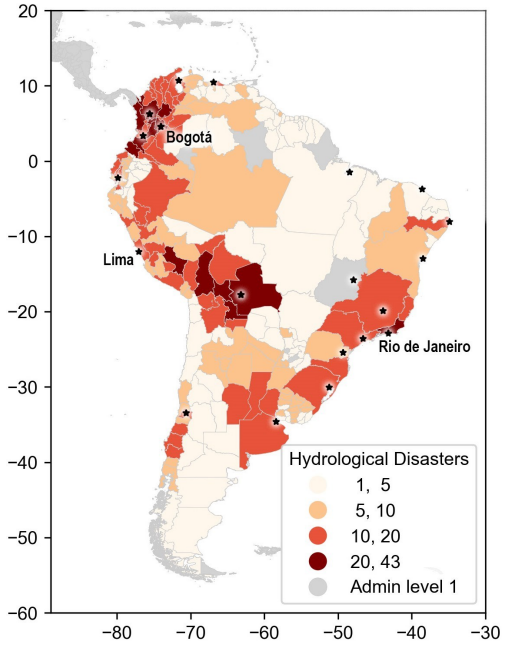

Fig. 3. Hydrological Disasters Occurrence in South America, at Subnational Level[4] (2000 - 2023)

Urbanization and Exposure

Flood related risks increased in recent years due to urbanization and associated exposure.[5,6,7] By representing the number of hydrological disasters at a higher granularity, it can be inferred that the higher prevalence of disasters surrounding major populated cities results from increased exposure surrounding areas of urbanization (Fig. 3).

In Brazil, recurrent catastrophic floods are largely concentrated along the southeast coast of the country, aligning with the country's most populous region. This is particularly true in the state of Rio de Janeiro and in the Metropolitan Region of Recife (Northeast Brazil), areas that have experienced rapid urbanization.[8] Similar spatial hotspots of flooding occur around several major cities in South America.

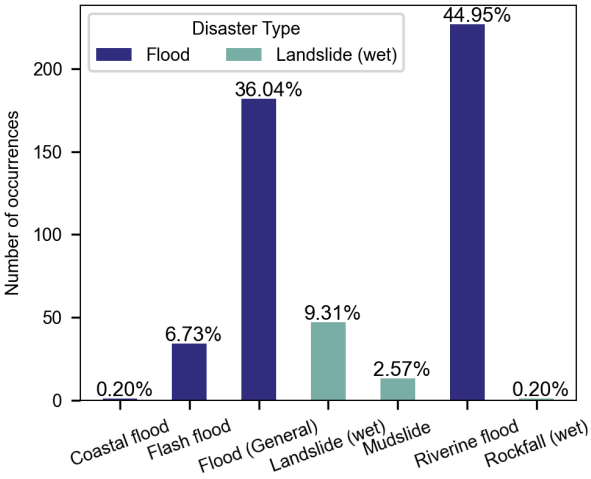

Fig. 4. Proportion of the Hydrological Disaster Subtypes among all Hydrological Disaster Type, in South America (2000 - 2023)

Conclusion

Between 2000 and 2023, 505 hydrological disasters were reported in EM-DAT, ultimately claiming 10,694 fatalities. Hydrological disasters remain the most prevalent form of disasters within the region, consisting largely of various floods (Fig. 4). Brazil, Colombia, and Peru have the highest occurrence of floods, and events appear clustered around populated regions. South America represents just one subregion among many that face similar hazard threats. Given the expected population growths, disaster risk management becomes a critical element in adapting to the world's changing environment.[9] Within this context, it is anticipated that data-driven research and mitigation policies will become increasingly important.

[3] United Nations Office for the Coordination of Humanitarian Affairs (OCHA). "Colombia: 2010-2011 Situation Report #21." https://www.unocha.org/publications/report/colombia/colombia-floods-2010-2011-situation-report-21.
[4] Unit levels are based on the Global Administrative Unit Layers (GAUL) as utilized within EM-DAT. https://doc.emdat.be/docs/data-structure-and-content/spatial-information/.
[5] OECD/The World Bank. "Colombia." In Fiscal Resilience to Natural Disasters: From Country Experiences. OECD Publishing, Paris, 2019. https://doi.org/10.1787/737349eb-en.
[6] de Assis Dias, M.C., et al. "Estimation of Exposed Population to Landslides and Floods Risk Areas in Brazil, on an Intra-Urban Scale." *International Journal of Disaster Risk Reduction* (2018): 449-459. https://doi.org/10.1016/j.ijdrr.2018.06.002.
[7] Reguero, B. G., et al. "Effects of Climate Change on Exposure to Coastal Flooding in Latin America and the Caribbean." *PLoS ONE* 10, no. 7 (2015): e0133409. https://doi.org/10.1371/journal.pone.0133409.
[8] Vasconcelos Junior, F. D. C., et al. "An Attribution Study of Very Intense Rainfall Events in Eastern Northeast Brazil." *Weather and Climate Extremes* 45 (2024): 100699. https://doi.org/10.1016/j.wace.2024.100699.
[9] IPCC. "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation." In A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC), edited by C.B. Field et al., 582 pp. Cambridge University Press, 2012.

CRED Updates

- New CRED publication, with participation of CRED: Donatti, C. I., Nicholas, K., Fedele, G., Delforge, D., Speybroeck, N., Moraga, P., Blatter, J., Below, R., and Zvoleff, A.: Global hotspots of climate-related disasters, International Journal of Disaster Risk Reduction, 108, 104488, https://doi.org/10.1016/j.ijdrr.2024.104488, 2024.

Analysis & Writing: Emilie Castin, Omri Shoshani, Damien Delforge, Regina Below, Niko Speybroeck, Victor Marchezini, and Joris A.F. van Loenhout.
EM-DAT: The BHA/CRED International Disaster Database. Centre for Research on the Epidemiology of Disasters (CRED), Institute of Health and Society (IRSS), UCLouvain. Email: contact@emdat.be