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Disaster risk communication organizational capacities at the age of extremes

Capacidades organizacionais de comunicação de riscos de desastres na era dos extremos

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Abstract: Several studies have warned about the increasing frequency of extreme weather and climate events like heavy rainfall, extreme droughts and heat waves, which have been intensified by the climate change and accelerated by anthropogenic actions. Climate change takes place in social contexts known for constantly changing. For instance, social disparity forms, such as inequality and racism, emerge and overlap within these contexts, and it makes some people more vulnerable to disasters. Digital extremes, such as disinformation about disaster contexts, are also increasing. Organizations must have disaster-risk communication capacities at the age of extremes to respond three extremes, namely: meteorological, social and digital extremes. The aim of the current article is to discuss disaster-risk communication organizational capacities at the age of extremes. A literature review on the concept of disaster was carried out, as well as a desk research in governmental publications about municipal civil defense and protection agencies, and a qualitative field research in the second semester of 2024 in Cataguases City – Minas Gerias State and in Nova Friburgo City – Rio de Janeiro State, Brazil, which are medium- and large-sized cities in Paraíba do Sul River Basin. According to the results, municipal civil defense agencies lack financial and material resources, and it compromises their communication capacities. The human resources available are also not enough. There is lack of training actions to deal with new risk communication challenges, such as disinformation on alerts outspread on social networks and messaging apps, as observed during the field research. Furthermore, people do not know what extreme events actually are. Despite these challenges, municipal civil defense agents develop communication strategies to deal with disinformation on both social networks and messaging app groups. Finally, the article highlights the need for analyzing communication capacities in place by monitoring contingency plans' implementation. These plans must be resilient to intersections among these meteorological, social and digital extreme scenarios.

Keywords: extreme events; disinformation; vulnerability; disasters; civil defense.

Resumo: Diversos estudos apontam para o aumento da frequência de eventos extremos de tempo e clima, como chuvas intensas, secas extremas e ondas de calor. Esses eventos têm sido intensificados por conta das mudanças climáticas, cuja aceleração é impulsionada pelas ações antrópicas e ocorrem em contextos sociais que também estão em constante transformação. Neles, se emergem e se sobrepõem outras formas de extremos sociais, como a desigualdade e o racismo que acentuam a vulnerabilidade a desastres, e extremismos digitais, como a desinformação. Diante dessas três formas de extremos (meteorológicos, sociais e digitais), as organizações da área de gestão de riscos e desastres precisam ter capacidades de comunicação. O objetivo do artigo é discutir as capacidades organizacionais de comunicação de riscos de desastres na era dos extremos. Para tanto, faz-se uso de revisão de literatura sobre o conceito de desastre, de pesquisa documental em publicações governamentais sobre os órgãos municipais de proteção e defesa civil e de pesquisas de campo de base qualitativa, conduzidas no segundo semestre de 2024, em Cataguases/MG e Nova Friburgo/RJ, municípios de médio e de grande

porte da Bacia do Rio Paraíba do Sul. Os resultados indicam que os órgãos municipais de defesa civil carecem de recursos financeiros e materiais, o que compromete suas capacidades de comunicação. Ademais, os recursos humanos são insuficientes no que diz respeito a ações de capacitação para lidar com novos desafios de comunicação de riscos, como a desinformação sobre alertas em redes sociais e aplicativos de mensagens, como evidenciado nas pesquisas de campo. Apesar desses desafios, os agentes municipais de defesa civil tecem suas próprias estratégias de comunicação para lidar com a desinformação em redes sociais e grupos de aplicativos de mensagens. A pesquisa também evidenciou desconhecimento sobre o que são eventos extremos. Destaca-se, por fim, a necessidade de analisar as capacidades de comunicação em ação, acompanhando a implementação dos planos de contingência, para que sejam resilientes a esses cenários de intersecção de extremos meteorológicos, sociais e digitais.

Palavras-chave: eventos extremos; desinformação; vulnerabilidade; desastres; defesa civil.

1. Introduction

"Age of Extremes" is the name of a famous book written by historian Eric Hobsbawm. He discussed the world wars taking place in the 20th century and their respective effects on societies. Accordingly, the link to the Age of Extremes refers to three ongoing processes that were later highlighted, in separate, in scientific research (McPhillips et al., 2018; Marchezini et al., 2023), in Sendai Framework (United Nations International Strategy for Disaster Reduction [UNISDR], 2015) and in global risk-analysis reports (World Economic Forum, 2025), namely:

i) extreme weather and climate events add challenges for people and organizations dealing with disaster risk;

ii) social inequality and racism extremes, which reflect on vulnerability to disasters; and,

iii) digital extremism based on outspreading disinformation about disaster-risk communication.

The third section of this article introduces the discussion about each of the three extremes: meteorological, social and digital.

The three extremes have influenced the precarious ways disaster risk management (DRM) is carried out by municipal civil protection and defense agencies. DRM can be herein defined "as permanent and continuous social process" (Ministério do Desenvolvimento Regional [MDR], 2021, p. 10) whose aim lies in addressing threats and vulnerabilities in the territory. It is done by supporting institutional and community organizations and structures.

Adverse and/or natural events, and/or anthropogenic processes triggering impacts, damage and losses are real threats (United Nations Office for Disaster Risk Reduction [UNDRR], 2017) of socio-natural (hurricane, drought, heat wave), biological (viruses, bacteria, among others) and/or technological (radioactivity, oil spill, among others) origin. In many cases, threats, such as the February 2021 flooding in Acre State and the Covid-19 pandemic, can happen simultaneously.

People and organizations can be exposed to threats, and they can be

more or lesser vulnerable to them. In other words, socially produced social, institutional, environmental and economic weaknesses increase the likelihood of suffering from impacts, damage and losses caused by these threats, as well as influence the recovery from disasters, or lack of it, in the short-, medium- and long-term (Valencio, 2012; Wisner, 2016).

Vulnerabilities are socially produced, because they depend on access to resources and livelihoods (Wisner et al., 2012) like access to water. Sometimes, large-scale social protection and risk mitigation policies are needed for reducing inequalities and providing access to minimum income and to other basic rights resulting from social and technological changes. Some examples of these changes are access to the internet and digital literacy to access public services mostly available in applications, such as storm alerts.

Although people show vulnerabilities, they can also have self-protection capacities that depend on access to resources in order to predict, prevent and mitigate risks; as well as to prepare for, and act in, emergencies and to recover from disasters (Wisner et al., 2012). These capacities are also influenced by institutions and organizations.

Institutional structures or institutions regard formal and informal rules regulating and influencing how people and organizations deal with certain issues, such as the legislation for disaster risk management (DRM) and social beliefs about disasters. On the other hand, organizations comprise groups of people who come together around a specific mission. Municipal civil protection and defense agencies, municipal social assistance departments, universities, NGOs, community associations, among others, are organizations involved in DRM and they must be able to accomplish their missions and comply with DRM accountability.

Organizational capacities represent organizations' ability to reach their goals (Barman & MacIndoe, 2012; Andrews et al., 2016), such as disaster risk reduction (DRR). These capacities correspond to factors like proper budget availability, a sufficient and qualified team, access to knowledge and information, use of planning tools and coordination mechanisms set with other organizations. These capacities must be used to take several DRM actions like risk communication.

According to Amaral et al. (2024, p. 36), "risk communication is broader than crisis communication, and it concerns outspreading information and data (...), although focusing on risk prevention, mitigation and reduction". Crisis communication, on the other hand, operates in the disaster response and recovery context. They highlighted that disaster situations boost disinformation circulation, which is a much better term than "fake news". It is so, because the term "fake news" compromises the relevance of journalistic work and undermines press credibility. Hameleers (2023) provided a brief overview of the state of the art of different definitions of "disinformation" and addressed it as any practice creating or outspreading

misleading contents to cause harm, conflict or to achieve political and financial gains. They also further showed that these fraudulent practices can range from taking recognized facts out of context to fabricating alternative narratives.

The aim of the current article is to discuss organizational disaster risk communication capacities at the age of extremes. Section two introduces the mixed research methods by using quantitative and qualitative data. Section three focuses three frameworks to help better understanding disasters, besides associating them with both the three extremes discussed in the introduction and the research data. Section four discusses municipal civil protection and defense agencies' organizational communication capacities regarding the three extremes, and highlights aspects related to financial, material and human resources, and governance. Finally, some challenges to research in the organizational risk communication capacities field are listed in the "Final remarks" section.

2. Methods

This study used qualitative field research and documental research applied to governmental publications about municipal civil protection and defense agencies (Secretaria Nacional de Proteção e Defesa Civil, 2021).

The qualitative research was authorized by the Research Ethics Committee (Opinion 7.076.442). The field research was carried out in the second half of 2024, in Cataguases City, Minas Gerais State, and in Nova Friburgo City, Rio de Janeiro State, Brazil. These are medium- and large-sized municipalities located in Paraíba do Sul River Basin. They were selected for their population size and history of disasters (Pacheco et al., 2023).

Two main data collection instruments were used in the field research, namely: direct observations and in-depth interviews. Field notes were used to record the observed meaningful matters about municipal civil protection and defense agencies' structures, and about communication challenges faced by the organizations and residents. Semi-structured interview guidelines comprised 12 questions about topics such as extreme events and warning systems. Two main questions will be herein discussed: "What is an extreme event?" and "What is a warning system?".

Civil defense agency representatives in these two municipalities accompanied the research team on most visits to neighborhoods located in areas facing risk of flooding and landslides. Oftentimes, it was not possible reaching some of these areas because they are controlled by drug dealers – even the civil defense agencies do not have access to them. Two areas controlled by the traffic were visited by the first author of the present article due to support received from a local non-governmental organization.

In total, 60 in-depth interviews were conducted with both public civ-

il defense officers and residents in neighborhoods located in areas at risk of flooding and/or of landslides in the two municipalities – attendees were randomly selected before the interviews. Explanations about the Organizational Capacities for Extreme Event Preparedness project, also known as COPE (supported by FAPESP, process 2022/02891-9), were given before the interviews. All attendees signed the Informed Consent Form. The interviews were audio-recorded in voice recording equipment whenever it was authorized by the participant; they lasted 30 minutes, each, on average. The interviews were transcribed in Transkriptor software and revised by the research team, right after the fieldwork. Fictional names were assigned to preserve interviewees' identity. Qualitative data collected over the fieldwork that had matched the scope of the present study were systematized into two main dimensions: social representation of extreme events and disinformation in alert communication.

The documental analysis was based on using quantitative data of the Municipal Survey on Civil Protection and Defense (Secretaria Nacional de Proteção e Defesa Civil, 2021). The first author of the present study joined this institution's data collection. Secondary data from 1.993 municipalities were used to analyze data from the organizational communication capacities' perspective, and it was a quite innovative procedure. These data were systematized and analyzed according to three dimensions:

i) financial and material resources substantiating organizational communication initiatives;

ii) human resources and training; and,

iii) communication capacities regarding governance.

Qualitative and quantitative data analyses were guided by the three-extremes approach (meteorological, social and digital) and by organizational risk communication capacities to allow dealing with them. These extremes were discussed, in separate, and published in the scientific literature on disasters (Gilbert, 1998; Marchezini, 2009) and extreme events (McPhillips et al., 2018; Marchezini et al., 2023). The current article innovated by discussing these extremes together as an attempt to problematize organizations' ability to communicate risks at the current age of meteorological, social and digital extremes. The next two sections address the research results in light of such an approach.

3. Frameworks to understand disasters and their implications for disaster risk communication at the age of extremes

'Disaster' definitions adopted by organizations are quite important as they guide their discourses, practices and disaster management solutions (Dombrowsky, 1998; Marchezini, 2009). Gilbert's (1998) synthesis of definitions was herein applied to help reaching the article purposes.

According to this French political scientist, there are three main paradigms crossing such definitions, namely:

i) disaster as threatening external agent;

ii) as social expression of vulnerability; and,

iii) as state of uncertainty generated by organizations themselves (Marchezini, 2009).

These three paradigms are the very basis for discussions about the three aforementioned extremes: meteorological, social and digital.

3.1. Disaster as threatening external agent, and extreme weather and climate events

According to the paradigm of disaster as threatening external agent, it is an exceptional phenomenon tending to disrupt "normality" and to bring along disorder to the social system. It works as if the system, itself, did not often produce its own unsustainable practices by filling floodplains and mangroves to open room for new ventures, among other human interventions. The language used in this reality framing framework is based on that known for often blaming "supernatural" features for the recorded disasters. In other words, natural phenomena, such as extreme rainfall, would be endowed with a destructive power to "punish" humankind (Marchezini, 2014). Expressions highlighting the "fury of nature" are common in this framing type. There is also the trend to blame rationality for natural phenomena, as if such events would make independent decisions aimed at taking people's lives. Headlines, such as "Rain causes deaths", "Rain causes damage" are often seen in the press (Valencio et al., 2005; Valencio & Valencio, 2017). People are seen as "victims", regardless of their income, skin color, gender, age and race, rather than agents who produce risks for themselves and others. This narrative intensifies the "atypical rainfall" discourse (Valencio et al., 2005), as the media classifies any meteorological phenomenon as "extreme" event, and it reifies the concept of 'external event', without questioning the economic growth models leading to disaster risks (Marchezini et al., 2023).

Socio-natural threats related to temperature and rainfall can be technically classified as 'extreme weather' or 'climate' events when they manifest conditions outside the usual occurrence patterns, such as high intensity or atypical durations, within a given region or period-of-time (World Meteorological Organization [WMO], 2023). Different statistical analyses have been used in meteorology, which is the science field mostly assessing atmospheric phenomena. They are adopted to help classifying "extreme events" (Nóbrega & Farias, 2016; Machado et al., 2019; Santos & Galvani, 2019; Tavares & Ferreira, 2020).

After understanding the definition of 'extreme events' in meteorology, it is essential differentiating extreme weather events from extreme climate

events. The words 'weather' and 'climate' are often used as synonyms. Although these concepts are interrelated, they differ in temporal scale. According to the meteorology, weather is the instantaneous and transient condition of the atmosphere, such as a rainy day or a sunny day. Climate, on the other hand, represents the spatiotemporal synthesis of weather conditions, such as rainy summer and dry winter (Reboita et al., 2012; Lovejoy, 2013).

An extreme weather event can be defined as unexpected variation in atmospheric states caused by macro-, meso- and microscale meteorological conditions like high- or low-pressure systems, warm or cold fronts, mesoscale convective systems and thermodynamic patterns taking place over short periods-of-time, from hours to days and even for a few weeks (Ynoue et al., 2017). Some studies, such as the ones by Pinheiro et al. (2014) and Mattos et al. (2020), applied the term "severe weather event" to name meteorological events linked to lightning, intense rainfall, hail and strong surface winds capable of causing damage, depending on where they happen.

Similarly, extreme climate events differ from extreme weather events. An extreme climate event is an unexpected variation in the local climatological component due to a succession of extreme weather events. Climate extremes, like drought periods, experienced in the Northeastern Region from 2012 to 2017, account for longer periods-of-time and spatial scales than extreme weather events; therefore, their effects tend to be gradual and affect more people (Silva Dias, 2014).

Definitions based on meteorology classify weather and climate events as extreme, regardless of their associated impacts and the vulnerability of the territory they take place in. Thus, taking the concept of extreme events as analogous to that of disasters is scientifically incorrect.

Although these definitions are accepted as true, after analyzing 244 articles related to extreme events, McPhillips et al. (2018) observed that this concept can have different interpretations depending on the study field. These divergences demand building bridges to foster a more integrated DRM approach, which should include interdisciplinary (between disciplines) and transdisciplinary (beyond scientific knowledge) approaches.

Developing glossaries to make the dialogue between scientists themselves, and between them and society (Marchezini et al., 2024), as well as specific manuals aimed at journalistic coverage of extreme events (Amaral et al., 2024), are ways to address the herein highlighted conceptual challenges. Nevertheless, further research is needed to analyze perception and communication factors related to extreme events based on different age groups (Marchezini & Londe, 2020), professions (Loose, 2020; Marchezini et al., 2022) and organizations (Zhang et al., 2018; Hess et al., 2023).

The field research allowed conducting 60 in-depth interviews, and the answers to the question: "what are extreme events?", were quite diverse. Overall, civil defense public managers and local residents reported not to

know what extreme events actually are, or sought to define them as situations capable of "disrupting" city routines, that can "get out of control" and have "the potential to cause damage, losses and victims". Sometimes, the hard time understanding and defining these terms is also associated with lack of knowledge, given their complexity and distance from people's daily lives. Sometimes, situations where people were "caught by surprise" by both storms and "atypical rainfall" are often recalled. As reported by the interviewees:

> *We consider an* extreme event *the one disrupting the city's normal functioning, you know? You change the traffic, cancel school days,* cause disruption *to the city and forces the complete shutdown to solve the problem (...) it's an* event with the potential*, the capacity to* cause damage, losses and casualties (Vanderlei, civil defense agent in Nova Friburgo /RJ) (emphasis added).

> *An* extreme event is one going beyond the normal*, far exceeding the normal range or the safety level.* (Erikson, civil defense agent in Nova Friburgo/RJ) (emphasis added).

> *It's something that, given it's extreme,* gets out of control (Jurandir, civil defense agent in Nova Friburgo/RJ) (emphasis added).

> *I hardly assessed it, I can't really specify.* (João, 65 years old, Nova Friburgo resident/RJ).

> *It's just like the 2011 tragedy.* (Paula, 18 years old, Nova Friburgo resident/ RJ).

> *An extreme event is what has been happening in the region where my mother's house is (...) for about three years now these* very concentrated storms *have started, right? And... In one instance alone, it happened five times, almost a meter of water in the house, it had never happened in 60-odd years.* (Flávio, 40 years old, Cataguases resident/MG) (emphasis added).

> *An extreme event would be like our situation there; it rains heavily in the headwaters and it* immediately affects *the people here.* (Luciane, 55 years old, Cataguases resident/MG) (emphasis added).

> *(...) a* very heavy rain *that occurred in Glória region, the water reached here, like, very strong, so* it caught a lot of people by surprise. *So, for me, this is an extreme event, you know? It was something* atypical *(...) so, it was something* very fast*, you know?* (Adenor, 42 years old, Cataguases resident/MG) (emphasis added).

This diversity of social representations of extreme events is often based on experienced damage and loss. In other words, it takes the extreme profile as reference point, based on the experienced or suffered impacts (Marchezini et al., 2023). They tend to highlight how fast storms and flashfloods took place to associate them with threats; at some sense, they approach meteorological phenomena classifications, regardless of the suffered impacts. Such diversity must be taken into account to plan mass alert outspread, as the recently adopted one for cell-broadcast systems activating cell phones within the range of cell towers, as storms approach the locations. This system has two alert levels, namely: extreme and severe alerts.

> The first level is the highest alert level, which is featured by extreme threats to life or property. The second level highlights the need for protective measures. The message in extreme alerts trigger a sound signal on the cell phone similar to a siren, even if the device is in silent mode; it achieves greater efficiency in alert situations. The sound signal in a severe alert is a 'beep', similar to that of an SMS; and it does not sound in silent mode (Secretaria Nacional de Proteção e Defesa Civil, 2024).

This system was implemented without any analysis of people's social perceptions of what extreme events are actually about.

Public officials and residents are often unaware of the uncertainty and difficulty in predicting these extreme events. The significant updates in science and technology have enabled the development of refined short-term and very short-term weather forecasting and now-casting techniques; however, important challenges remain, in this field. The complexity of physical factors influencing the definition of weather and climate sets significant limitations to the task of issuing effective and timely warnings. Furthermore, lack of State investments in both infrastructure and meteorological agencies, at national, state and municipal level, should be understood as failure, as it stems from decisions that compromise this system's technological and operational improvement. Failures, uncertainties and limitations become fertile ground for disinformation production in any case. Predicting these situations, and addressing uncertainties and limitations with the public is also part of a disaster risk management strategy. It would be a preventive action against disinformation proliferation during emergency and disaster situations.

3.2. Disaster as social expression of vulnerability, and the inequality and racism extremes

The disaster paradigm as social expression of vulnerability addresses it as event or process. When it is understood as 'event', the goal is to analyze people's vulnerability, at a given moment or disaster stage; i.e., emphasis is given on who is vulnerable. The quantitative survey carried out by both IBGE and the National Center for Monitoring and Alerts of Natural Disasters (Cemaden), is an example of it. This survey identified 8.2 million people and 2.5 million households living in areas at risk of floods and landslides within a sample of 872 Brazilian municipalities (Dias et al., 2018).

When it comes to the sense of 'process', disaster is a process of vulnerability, and the aim is to understand why and how vulnerability is socially produced, over time. The Pressure and Release framework is an example of it (Wisner et al., 2004; 2012). It seeks to identify the basic, or root, causes of a given disaster, such as income inequality and racism, as well as the dynamic pressures intensifying these root causes, like real estate speculation, among others. These root causes and dynamic pressures influence people's way of life and access to land, housing, water and other basic rights. This

progression of vulnerability experienced by people will make them prone to suffering damage and losses due to threats such as heat waves, floods and landslides.

Understanding vulnerability to disasters as event and process allows giving special emphasis to the vulnerability of different social groups because of income, age and gender features, among others. Gomes et al. (2022) highlighted that people with disabilities (PwD) have not been part of disaster prevention policies. Lack of data, information and knowledge about PwD; exclusion from the DRM stages (prevention, mitigation, preparedness, response and recovery); inaccessibility to communication and to preparedness measures for emergencies and alerts; stigma and discrimination, are among the disabling barriers for this population's inclusion in this process.

The racial dimension, in its turn, is not even mentioned in the National Policy for Civil Protection and Defense – PNPDEC (*Lei nº 12.608*, 2012). No disaggregated data of homeless, displaced and deceased individuals take into consideration this dimension in the Disaster Information System (S2ID). After all, structural racism is part of the Brazilian society. According to data from the Ministry of Human Rights and Citizenship, 5.200 racial violations were reported in 2024, alone (Ministério dos Direitos Humanos e da Cidadania, 2024). There is a belief that racism amplifies social inequalities, in addition to subject Black people to more vulnerability and take them away from their rights. The research team observed the situation of a Black woman, name Ana. She is in a wheelchair and was affected by the 2011 disaster in Nova Friburgo/RJ. She is living in a housing complex built for those displaced by this disaster. The new housing complex has experienced constant flooding, despite being occupied by drug dealers. According to Ana, the socio-environmental challenges in the peripheries are complex, and the risks are not always communicated from their perspectives to give visibility to the oppression they live in:

> *I'm the community leader here. That's why I'm so upset. And she's my helper, she helps me because* I can't walk *[without a wheelchair], and she helps me. (...) That's that ditch over there (...).* It was full of trash that people throw in*, clothes, pieces of fabric from clothing factories; people don't know what they're doing. So all* that stuff got clogged up*. So* as it rained, it all flooded*. Water almost came inside here. That huge ditch, the* water stayed there for a long time, and dengue coliform bacteria started to breed in it*. You understand? Not coliform bacteria, the dengue bacteria. You understand?* (Ana, 56 years old, Nova Friburgo resident) (emphasis added)

The research team was unable to access some areas controlled by drug dealers during the field research in Nova Friburgo/RJ and Cataguases/MG, although it was accompanied by municipal civil defense agencies. There were times when people did not want to speak or did not authorize the interview's recording for fear of retaliation by the dealers.

It is important taking into consideration these increasingly extreme

ways of life (of surviving), according to which, inequality and racism overlap other layers of precariousness that make people increasingly vulnerable. Intersectional approaches (Akotirene, 2018; Collins, 2022) must take into account the social extremes and other herein discussed extremes, as well as question whether the implementation of public policies (which applies to the PNPDEC itself) is not leading to inequalities (Pires, 2019). Thus, it is important recalling the recent Covid-19 biological disaster example, when disaster bio-politics, based on the "saving lives" discourse (Marchezini, 2015b) was relativized and triggered 'necropolitics'. In other words, this policy focused on multiplying the risk of death for some, on promoting exclusion, rejection and abandonment (Foucault, 2008; Mbembe, 2019; Mbembe & Shread, 2020).

According to Foucault (2008) and Mbembe (2019), 'necropolitics' sometimes manifests itself through State racism; it uses the argument of distinction, qualification, and hierarchy of races or social groups, to justify the death of some to benefit the collective. This discourse type became clear in speeches aimed at relativizing the relevance of each death in order to keep essential services running during the Covid-19 pandemic. This logic has been adopted by 'autocratic' governments and spread over organizations. Terms, such as LGBTQIA+ and equity, were ruled out from their policies. Consequently, the offered policy and service types, including those related to disaster risk communication, were also excluded from these policies.

Finally, the disaster paradigm as social expression of vulnerability can be discussed from taxonomic perspectives, such as from institutional, educational, political and economic vulnerability aspects, among others (Wilches-Chaux, 1993; Marchezini, 2015a). Among the eleven vulnerability typologies proposed by Wilches-Chaux (1993), cultural vulnerability, which, according to him, is expressed through how individuals see themselves and how the media conveys stereotypical images about the environment and disasters, is the one closest to communication. Based on field research results, the research team proposes a new typology for Wilches-Chaux's (1993), the so-called 'communicational vulnerability', which regards weaknesses linked to the communicative process. It includes, among other aspects, how organizations and individuals communicate, outspread, check and replicate information and disinformation about risks and disasters. The next subsection goes deeper into this discussion.

3.3. Disaster as uncertainty state, and digital extremism

According to the 2025 World Economic Forum's Global Risks Report (World Economic Forum, 2025), disinformation is a short-term threat with the potential to destabilize societies, undermine trust in governmental institutions and hinder the cooperation essential to address global crises.

The concept of disinformation derived from different understandings; among them, one finds that of the High-Level Expert Group on Fake News and the Online Disinformation of the European Commission (2018). They stated that disinformation includes all forms of false, inaccurate or misleading information designed, presented or promoted to intentionally cause public harm or to create some sort of profit to those spreading it. Hameleers (2023) also considered the proposition by Bennet and Livingston (2018), according to which, sociopolitical relationships and regional disinformation contexts are crucial and should be taken into account in order to develop a better conceptual definition of disinformation.

Some examples observed during the field research conducted in December 2024 in Paraíba do Sul River Basin comply with the understanding of the aforementioned authors. It is so, because these municipalities historically suffer from socio-environmental disasters mainly related to floods and landslides. The disinformation type reported by local residents and public officials referred to footage of old floods; they are taken out of context and used as images of recent events. The outspread of misleading contents aimed at causing harm can be easily observed (Hameleers, 2023), as well as the relevance of regional contexts (Bennet & Livingston, 2018).

The outspread of false information has been driven by time acceleration, which is observed not only in the communication field, but in several other contemporary social dynamics (Prazeres & Ratier, 2020). The time to produce and receive news during the analog technology age was considerably long. Daily newspapers, weekly magazines and television shows allowed more sophisticated fact-checking.

Clearly, disinformation was possible at that time; however, it is understandable that the outspread of misleading information is easier in the contemporary world, where real-time information often circulates without journalistic mediation. The excess of information brought about by the ease and speed of digital media, to a large extent, is another aspect to be taken into consideration. It makes receivers exhausted and more vulnerable, since it weakens their discernment skills (Prazeres & Ratier, 2020).

This disinformation scenario can influence the DRM field as it recalls discussions by the political scientist Claude Gilbert (1998) about disasters in the polarized Cold War world and about how DRM organizations not only deal with uncertainties, but also produce them.

Gilbert (1998) used the Chernobyl nuclear disaster example to explain the disaster paradigm as uncertainty state generated by organizations themselves. According to him, there are situations where information about risks and disasters is controlled by organizations or by some of their leaders, so that lack of information leads to an uncertainty

or paralysis state regarding whether or not to act, and it compromises DRM actions. However, they also listed cases where several organizations outspread conflicting information and diagnoses to create doubts and uncertainties in those who need to use such information to support their decision-making. Municipal civil defense organizations dealing with the public, for instance, do not always have autonomy over meteorological data produced by third parties; therefore, they depend on data from other state, federal or private organizations to substantiate their alerts and to communicate them at local level.

Informal conversations and in-depth interviews with civil defense managers during field observations provided examples of these communicative competition processes. These competitions were common between public organizations; between public and private bodies; and between organizations and digital influencers. Municipal managers reported to receive several alerts from federal and state agencies, besides dealing with digital influencers who use meteorological information to spread their own alerts among their followers. Many people call the municipal civil defense or get in contact with it through messaging apps and social media when they are faced with alerts from digital influencers. "*I receive messages on WhatsApp, Facebook, Instagram, right? The City Hall's Instagram too*", explained a civil defense agent in Nova Friburgo/RJ. The municipal civil defense is overwhelmed in responding to information reliability.

Reports from public managers and residents addressing the challenge of outspreading alerts on social media were heard during the field research, as well as numerous examples of disinformation about disasters, mainly on messaging apps. According to residents and Nova Friburgo (RJ) public managers, the 2011 disaster led to disinformation, and it caused widespread panic. Disinformation situations were also reported in Cataguases/MG:

> *And the day after the tragedy, someone even said that there was, as they say, a dam bursting at a certain point in the city center (...) And the* panic was terrible*, there were so many people running, really running, climbing the mountains, people in cars on streets they could get out of (...) People wandering about the streets, looking for a place to hide from the tragedy, right? And then* some malicious people said that. It drove everyone crazy. (Lucia, 45 years old, Nova Friburgo resident/RJ) (emphasis added).

> *Taking advantage to* disorient people*. It wasn't guiding, it was disorienting people, because everyone was going crazy. It's* fake news *(...). After everything that had happened the day before. And then, news like that comes along, you go crazy, right? People get desperate.* (Ana, 50 years old, Nova Friburgo resident/RJ) (emphasis added).

> *But there was* a lot of disinformation*, there were people getting sick here (...), having heart attacks, it was very sad. It was really bad, cars coming the wrong way, people running, desperate, because they were telling us to go up.* (Civil Defense agent from Nova Friburgo/RJ) (emphasis added).

> *There's* a lot of fake news*, right? There are many [channels] that are reliable, like, coming from a newspaper, right? A reliable journalistic company, a reporter that we already know is honest, but there's a lot of fake news. So* when you see an alert like that, you have to investigate to see if that alert is really serious*. (...) Then you have to look for a department the city hall, the police station, to show it, to find out if that's really true.* (Lucrécia, 35 years old, Cataguases resident/MG) (emphasis added).

> *(...) there's a lot of* fake news too. There are many people who take a video from the previous year and post it*, and sometimes it's not even a flood of that magnitude, and people post that, you know? So some information is unfounded.* (João, 42 years old, Cataguases resident/MG) (emphasis added).

Municipal civil defense officers also shared their strategies to deal with disinformation, including the creation of footages to report information – footage date and time must be recorded on the video, as well as the identification of each person on it. Sometimes, the municipal civil defense, itself, creates WhatsApp groups to inform residents about likely events. Communication or interaction between people is not allowed in these groups. There are times when these groups are created by residents themselves. Survivors of the 2011 catastrophe in the mountains of Rio de Janeiro State created WhatsApp groups to share information about rainfall and flooding, inundations and landslides events. The WhatsApp group moderator alternates between allowing communication and interaction between people, and outspreading information. Information is shared by participants in written text, photos, footages, audios and by forwarding alerts by municipal, state, or federal agencies, whenever they are allowed to. These initiatives are not exempt from disinformation cases, such as posting footages of old disasters as if they were current. The group moderator ends up embodying the role of monitoring disinformation.

These social changes come along with climate change, and it poses challenges to disaster risk management, including to the disaster risk communication field. The three meteorological, social and digital extremes challenge organizations' ability to communicate risks disasters. The following section discusses State and organizational capacities, which are rarely addressed in the disaster risk communication field.

4. Communication capacities in municipal civil protection and defense agencies

Debates on State DRM capacities are scarce in the literature (Oda et al., 2025). Cingolani (2013) explained that they regard the combination of one or more State-power dimensions aimed at taking coercive, military, fiscal, managerial, territorial control, legal and political actions. She reasoned on these dimensions and highlighted the need for asking "capacity for what?".

The present article points out the risk and disaster communication capacities of municipal civil defense agencies.

Organizational capacities encompass aspects such as sufficient budget and specialized personnel, access to knowledge and information, planning tools, and coordination mechanisms set in partnership with other organizations and social actors (Kamruzzaman et al., 2023; Chudnovsky & Fernandez, 2024). The following subsections address aspects related to financial, material, human and governance resources as contributing elements to organizational communication, which is influenced by socioeconomic contexts (Kunsch, 2014), rather than just being collective actions taken by the public in reflexive connection with organizations (Henriques, 2017).

4.1. Financial and material resources to support organizational communication initiatives

Budgeting is an essential element for public policy implementation. Municipal civil defense agencies do not always have the budget to implement the National Policy for Civil Protection and Defense (PNPDEC) (Damacena et al., 2022; 2023). According to the Municipal Survey on Civil Protection and Defense (Secretaria Nacional de Proteção e Defesa Civil, 2021), 72% of the 1.993 surveyed municipalities did not have their own budget.

Lack of financial resources limits the material resources available to support risk and disaster communication actions. In total, 30% of the assessed municipal civil defense agencies did not have a computer, a fact that can compromise access to important data and information about risk communication actions. Lack of a computer can impair the production of databases on flood and landslide occurrences, the storage of images and inspection reports, among other important records for DRM. Furthermore, it can also be a barrier to access risk maps plotted by the Geological Survey of Brazil (GSB), alerts sent by 'Cemaden', as well as to complete the S2ID form and attend training activities.

Many municipal civil protection and defense agencies (67%) also lacked their own vehicles, and it can compromise on-site visits to contact people who do not have access to the internet, mainly in case of heavy rainfall. It is important observing situations where municipal civil defense agencies have vehicles, but they are broken or lack fuel due to reduced operation costs. All these factors can have straight impact on the effectiveness of risk communication efforts.

The digital inclusion of municipal civil defense agencies is another rarely addressed aspect. Almost 70% of civil defense agencies reported not to have access to specialized software. Some free software allows plotting some maps that can make communication with people who need to locate

risk areas in a given municipality easier, and guide them to support points, safe areas and potential escape routes.

The Municipal Survey on Civil Protection and Defense (Secretaria Nacional de Proteção e Defesa Civil, 2021; Londe et al., 2023a; Marchezini et al., 2025) informed that 53% of municipal civil defense agencies do not have cell phones with access to the internet. This vulnerability adds to other barriers shared during the field research in Paraíba do Sul River Basin, in December 2024. Civil defense agents from the largest municipality (a group of 40 people – none with specific training in social communication) reported challenges related to communication capacities.

One of these challenges related to communication infrastructure associated with internet coverage, mainly in rural areas. "*This is a rural area. So we kind of don't know what's happening in other neighborhoods*", stated a civil defense agent from Cataguases/MG. The bureaucratic barriers to comply with regulations about cell phone towers' installation, lack of transmission towers of telephone operators outside large urban centers, and lack of lithium batteries in the towers due to power outages are factors compromising risk monitoring and communication actions. Even locations where towers are placed on have problems as these towers fail during heavy rainfall. This scenario requires other communication means, such as analog radios, which are quite important in case of internet and power outages. However, not all public or private organizations have this communication equipment or know how to use it.

Communication during emergencies and disasters, which tends to be more intense during extreme events, is another relevant factor. There is internet signal loss due to heavy rainfall and strong winds, and it compromises communication processes and alert outspread:

> *Even today, if there's a problem, a cascading, climatic event that affects cities and causes a power outage, right? [...] Let's suppose that a storm comes. [...] How are you going to send an SMS warning to people, how... how are you going to reach the entire population?* (Civil Defense agent from Nova Friburgo/RJ).
>
> *How are you going to manually activate 36 sirens in a timely manner?* (Civil Defense agent from Nova Friburgo/RJ).
>
> *But I think that even today, if the power goes out, there's nothing we can do.* (Civil Defense agent from Nova Friburgo/RJ).

Amateur radio transmitting station operators are essential during hazardous situations. In many cases, networks of volunteer amateur radio operators help with communication during disasters. The actions by amateur radio operators during the 2011 catastrophe in the mountains of Rio de Janeiro were recalled during interviews with civil defense officers and Nova Friburgo residents/RJ:

> *So we made friends with the people from the universities there, UFRJ, a bunch of universities. They thought it was super interesting and they got us a system that uses amateur radio. And we set up an amateur radio network to monitor the basin. And who has the radios? It's me, I'm the one in charge. There are several people. They took amateur radio tests and so on, you know?* (Civil Defense agent from Nova Friburgo/RJ)

Despite its key role, there is lack of investment to improve this communication type's infrastructure. The National Emergency Amateur Radio Network (RENER) was created in Brazil by Ministerial Decree MI-302, from October 24, 2001 to add to usual communication means, when they cannot be activated due to a disaster (Ministério da Integração Nacional, 2001). The Ministry of Regional Development created RENER and assigned the Brazilian Amateur Radio League (LABRE) to coordinate a joint operation with the civil defense. However, only 24% of municipal civil defense agencies have amateur radio stations (Secretaria Nacional de Proteção e Defesa Civil, 2021).

4.2. Human resources and training

Sufficient and trained human resources are other important aspects regarding communication capacities. A large fraction of civil defense teams (59%) in Brazil only count on one or two people, and 31% of their members reported to have less than one-year experience in civil protection and defense. Small, unstable and inexperienced teams are often observed in many municipal civil protection and defense agencies (Secretaria Nacional de Proteção e Defesa Civil, 2021; Marchezini et al., 2025). Lack of social understanding about what civil protection and defense is, and what are its responsibilities (Bonelli et al., 2022), including the communication field (Londe et al., 2023b), is a common scenario.

Marchezini et al. (2022) applied an online questionnaire to 1063 municipal and state civil protection and defense agents from October to December 2021 to assess their perspective of the climate change issue. Approximately 38% of respondents said to get information about climate change through the media, whereas 24% get their information through social networks and 18% through messaging application groups (WhatsApp). Only 13% of respondents said to get their information through lectures, workshops and other training courses.

Most civil defense agents (80.6%) fully agreed that climate change will cause additional challenges to the DRM, but only 10.1% of them believed they are prepared to deal with them. A quarter of respondents (26.3%) stated that they fully understand information about climate change, but they also believe that trusting information sources is a challenge. Approximately 93% of them said to trust information provided by scientists, but trust levels on information provided by governments and media outlets were lower.

Importantly, such lack of trust in information sources also happens among citizens, as observed in previous studies (Marchezini & Londe, 2020; Toff et al., 2021).

The rate of civil defense agents who fully agree that climate change is actually in place (77.6%) is approximately 18.6% higher than the rate of those who said to be concerned with the intensification of extreme events. This finding points out that a significant fraction of civil defense agents did not see a clear association between climate change and the higher intensity of extreme events.

With respect to training on climate change, 68% of civil defense agents highlighted the need for acquiring basic knowledge of meteorology in a specific workshop. Confusion between concepts, such as extreme weather and climate events, cyclones, tornadoes, flash floods, waterspouts, floods and inundations is recurrent, both among the agents themselves and in communication channels. The incorrect use of these terms not only hinders the clarity of guidance given to citizens, but it can also generate disinformation, a fact that influences the population's perception of threats and risks.

This scenario is especially relevant if one bears in mind the information network involving everyone, from the technical professional responsible for weather forecasts to the media, and civil defense agents themselves, who get the information first hand and pass it on to the population. Chances are that the received information can trigger protection actions when there is coherence in information outspread in this network. A well-structured training course to clarify these differences would be crucial to improve risk communication, allow civil defense agents to communicate better and contribute to public awareness of extreme events.

It is important pointing out that training suggestions should also be based on qualitative field research, on in-depth interviews, direct observation and ethnography, to help better understanding the daily communication capacity challenges faced by municipal civil protection and defense agencies. It is also important engaging with other knowledge fields, such as organizational communication (Kunsch, 2014; Henriques, 2017), to identify training suggestions. Romero-Rodriguez et al. (2018) stressed the need for access to media literacy and for critical thinking skills to fight disinformation. They defined media literacy as the development of technological and linguistic capacities, but also as learning to produce and interact with the informational content to be developed within an aesthetic and ethical context. Critical thinking skills, in their turn, are the idea of developing participatory and democratic interaction by the recipient audience.

4.3. Communication capacities in action: governance challenges

In total, 56% municipal civil defense agencies in the Elos Project (Secretaria Nacional de Proteção e Defesa Civil, 2021; Londe et al., 2023a; Marchezini et al., 2025) reported to use social media to communicate with the population; 43% of them use messaging applications; 31%, radio; and 25%, SMS alerts, to do the same. Yet, approximately 20% of them use educational campaigns and meetings.

Civil defense agents highlighted challenges related to disinformation on social media and messaging apps during field research, as well as the strategies adopted by municipal organizations to predict and minimize these situations. Nova Friburgo civil defense counts on the support of a group of volunteers led by *Instituto Friburgo Solidário*. It has been working to outspread real-time images from monitoring cameras installed by the institute. This system was possible thanks to donations from companies and volunteers in the municipality. This network's WhatsApp groups operate in such a way to allow attendees to share content and to find old disaster footages taken out of context. Sometimes the disinformation chain is disrupted by real-time images taken by these cameras, although the created fake news makes the press and ordinary individuals request more information from the municipal civil defense that, in its turn, ends up dealing with a "flash-flood" of phone calls or messages to be answered on Instagram, Facebook or WhatsApp. Sometimes, the resulting crisis is a communication, diverting time and human resource likely used for other assignments based on preparations to deal with emergencies.

Discussions about these challenges and on how to get better prepared for extreme weather and climate events have encouraged civil defense agents to think about solutions. The municipal civil defense coordinator in Cataguases/MG informed the research team that he is contacting municipalities in Rio de Janeiro forming the Paraíba do Sul River Basin and downstream Cataguases a few days after the field research in this city. The aim of creating a WhatsApp group for municipal civil defense agencies in Minas Gerais and Rio de Janeiro states was to share information on accumulated rainfall and water levels in the basin's rivers. It was done to make the proactive preparation for alert situations easier. This communication skill is also related to governance, as it regards coordination mechanisms on the Disaster Risk Reduction (DRR) topic set by organizations and actors, altogether. Nevertheless, it is essential highlighting that this skill type is dynamic and subjected to changes (Henriques, 2017) due to, for example, changes in municipal, regional and state civil protection and defense agencies' personnel (Loose et al., 2023). Therefore, capacities can be developed through a network, but they depend on coordination.

Examples based on field research help understanding how organizations deal with different extremes that, in their turn, accumulate and

generate new challenges to DRM. Accordingly, it is worth pinpointing the need for regular reviews of the Continuous Training Plan of the National Secretariat for Civil Protection and Defense (Secretaria Nacional de Proteção e Defesa Civil, 2024b). Its latest edition was published in 2024 and it is valid up to 2028. There is no training action focused on risk communication or on addressing disinformation within risk and disaster contexts.

5. Final remarks

The aim of the present article was to discuss organizational risk communication capacities at the age of extremes. Initially, the three main models used to better understand disasters were introduced as external threat agents, as social expression of vulnerability and as uncertainty state generated by organizations themselves. They were associated with three forms of extremes, namely: meteorological, social and digital extremes. This discussion linked literature review to both documental analysis and results of a qualitative field research.

The paradigm of disaster as threatening external agent has been updated by recurring discourses on extreme events. Rainfall events tend to be classified into this category, although, in scientific terms, they often meet the criteria and thresholds proposed by the meteorology. Furthermore, there are complicating factors related to lack of knowledge about what extreme events actually are, among public managers and residents. This lack of knowledge is also observed among civil defense agents who often miss training courses on the climate change and extreme events topic. It is worth highlighting the lack of trust in information sources, mainly when it comes to information provided by governments and the media. All these factors influence organizational risk communication capacities.

The paradigm of disaster as social expression of vulnerability is not always seen as social extreme, despite the increased social inequality and racism forms. Lack of knowledge about vulnerability situations experienced by social groups, as well as about the formulation and implementation of public policies aimed at specificities based on gender, age, ethnicity and racial profiles, and on other dimensions, remains a reality, in many cases. This limitation is seen in the National Policy for Civil Protection and Defense (PNPDEC), which does not keep pace with both care evolution and the availability of other social policies, such as the National Social Assistance Policy. Lack of disaggregated data in the Disaster Information Form (FIDE), which is the main instrument for disaster assessment in Brazil, is an example of it. These limitations are not the only worrisome, since there is concern with those emerging from large-scale disasters, as the Covid-19 pandemic

case. 'Necropolitics' may arise from these national public calamity situations; in other words, it multiplies the risk of death in some social groups due to the use of State racism forms often implemented by autocratic governments. These governments implement a series of setbacks in social policies and it ends up influencing organizations and, consequently, their risk communication policies for ignoring the social and digital exclusion forms.

Finally, it is worth highlighting the paradigm of disaster as state of uncertainty generated by organizations themselves. It is associated with digital extremism forms exemplified by disinformation cases in risk and disaster scenarios. The disinformation dynamics has spread through social networks and messaging applications forming a new vulnerability form, the so-called communicational vulnerability. Field research results pointed out some challenges faced by municipal civil protection and defense agencies to deal with this issue, as well as with strategies adopted to show up their organizational capacities. Nevertheless, municipal civil protection and defense agencies face structural difficulties like lack of financial, material and human resources to implement the National Policy for Civil Protection and Defense (PNPDEC) in municipalities.

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