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Detecting Information Voids During Floods in the Central European Region

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Highlights

- This research aims to detect information voids (IVs) during the Central European floods, a critical issue exacerbated by climate change and increased urbanization. The study employs rapid pulse surveys as an innovative data collection method, enabling efficient outreach to a large sample size during emergencies.
- We propose an operational definition of IVs as a four-dimensional problem encompassing gaps in informational quality, quantity, sources, and channels. This nuanced understanding allows for targeted interventions in regions such as Belgium, Germany, and Poland, where similarities and differences in IVs are examined.
- To improve flood preparedness in Central Europe, future research should analyze how information gaps affect specific communities. Policymakers must integrate these findings into emergency communication, allocate resources effectively, and engage with communities through preferred channels. Localized training for emergency managers should include modules on identifying and addressing information gaps. Continuous assessment of information dissemination during emergencies, informed by community feedback, will allow for real-time adaptation and enhance preparedness.

Research Context

Anthropogenic climate change and rising urbanisation have contributed to a surge in urban flooding over the past 20 years (Sun et al., 2021). These natural hazards impose a destructive burden on the economy through derailment of services and immediate risks to human life and livelihoods (Agonafir et al., 2023). A critical challenge for the government and disaster management stakeholders during flood-related emergencies is the disruption of communication infrastructures ranging from telecommunication networks to news media services. Consequently, these disruptions impede the delivery of effective and accurate information to the public, who may be confronted with many emergency-borne situations at the individual, family/household, or community levels.

To fill the void created by the gap in flood relief communications, the general public engages in emotional conjecture on ubiquitous platforms like social media, as seen during Hurricane Maria (Pérez-Figueroa et al., 2024). The COVID-19 pandemic has taught us that social media can become a fertile ground for the proliferation of misinformation, disinformation, and conspiracy theories as the general public attempts to make sense of a situation where the establishment is communicating minimally or inefficiently (Gallotti et al., 2020). This, in turn, can have downstream effects, including the uptake of risky health behaviours, confusion about best healthcare practices, mistrust of accurate (e.g., public health) information sources, poorer adherence to health-conducive public directives, and economic consequences.

The vacuum may be characterised as an "information void", a phenomenon that has drawn the attention of scientists from across disciplines but has not yet been comprehensively defined. For instance, economists define information voids (IVs), quite simply, as the absence of readily available and credible information (Kingsley & Graham, 2017). This operationalisation presents IVs as a function of structural and quality considerations related to information but does not account for the source of the information. Purnat and colleagues (2021) developed a taxonomy for a social listening tool to detect information voids in online conversations during the COVID-19 pandemic. While this research discovered the ebbs and flows of specific conversation themes (causes, treatments, misinformation, etc.), the question of the dimensions that characterise information void was left unascertained as were considerations of non-social media users. This may include individuals who may not be active on specific social media platforms, may not have access to social media platforms, and those at the poorer end of the digital inclusion spectrum (Ramsetty & Adams, 2020; Van Dijk, J.A.G.M, 2008)

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The Purnat study's findings were however useful in highlighting that the quality of information would be a critical component of information voids as it highlighted the presence of misinformation and conspiracy theories in online spaces. Scholars have also alluded to the problem of information quantity – information insufficiency to be precise – that arose during the Swedish floods (Lakew & Olausson, 2023). Studies of flood risk communication have revealed a discrepancy between people's preferred or trusted sources of information and the sources from whom they received information. The channel(s) through which communications are delivered – TV, newspaper, social media, etc. – are equally important as there may similarly be a need gap between people's preferred information channel and the ones they can access during a flood event (Wilkins et al., 2018). In this brief, we elaborate on the conceptual approaches noted above and present preliminary findings from among the few attempts to quantify IVs from the perspective of individuals who may have been directly or indirectly affected by the 2024 floods in Central Europe. Equally, given the resource constraints faced by the emergency preparedness community, we explore whether rapid pulse surveys can be used to detect IVs.

Operational Definition: Based on our literature review, we propose an operational definition of an IV as a 4-dimensional crisis communication problem characterised by gaps in informational quality, information quantity, information sources, and information channels. The voids for these dimensions are simply understood as gaps between experience-based perceptions and the ideal or people's stated preferences. As in, a quality void is the gap between the perceived quality of information and fully accurate information. A quantity void is the gap between the perceived quantity of information and the ideal amount. A source void is the gap between trusted and actual sources of information. Lastly, a channel void is the gap between preferred and accessible information channels.

Based on the above rationale, we seek to explore the following research questions:

RQ1: Can information voids be detected through rapid pulse surveys?

RQ2: In which of the four dimensions - quality, quantity, sources and channels - were the voids most pronounced in the context of Central European floods?

RQ3: What are the similarities and differences across the four dimensions of information voids in Belgium, Germany and Poland?

Methodology

To map IVs, we administered an English-language survey online via Qualtrics among N=590 adults in Belgium (N=202), Germany (N=197), and Poland (N=191). Participants were aged 18 years or older and fluent in English. The survey required participants to respond to a series of scale-type questions pertaining to information acquired during a flood event. These scales probed IV perceptions surrounding information content (quantity and quality), source, and channel.

For the content dimension, participants rated the quantity and quality of different information needs during a flood risk event on a scale ranging from 1 to 21. For the quantity index, a rating of 1 indicated a complete absence of information, while 21 indicated an overabundance of information. For the quality index, a rating of 1 indicated that participants perceived the obtained flood information as completely false/

misinformation/propaganda. In contrast, 21 indicated that received information was perceived to be entirely accurate. The probed information needs were adapted from Phuong et al. (2021), and Leelawat, Pee, and Iijima (2013), and consultations with local flood risk communication experts. For example, items include where and when the flood would arrive.

To identify source IVs between trusted and actual information sources accessed during a flood, participants rated the frequency of consulting each information source (e.g., friends, family, or local government) on a scale of 1-21. For the index of trusted information sources, a score of 1 indicated that the participant never consulted that information source and a score of 21 indicated that they always consulted it. For the index of accessed information sources, a score of 1 indicated that the participant never consulted that information source during the flood, and a score of 21 indicated that they always consulted it. The list of trusted and actual information sources was adapted from Burger et al. (2013) and included, for example, friends, emergency services, and local government.

Finally, to capture information channel IVs, participants rated the frequency of consulting different information channels (e.g. television, radio, or social media) on a scale of 1-21. For the index of preferred information channels, a score of 1 indicated that the participant never consulted that information channel, and a score of 21 indicated that they always consulted it. For the index of accessed information channels, a score of 1 indicated that the participant never consulted that information channel during the flood, and a score of 21 indicated that they always consulted it during the flood. The list of preferred and accessed information channels was adapted from Burger et al. (2013).

Computation of IVs

The computation of information voids (IVs) across four dimensions—quality, quantity, source, and channel—followed a systematic approach to quantify the gaps between the actual information individuals received and their ideal preferences. In the first step, the quality void (QLv) was calculated as the difference between perceived quality (Pql) and an ideal quality score of 21, based on the assumption that individuals preferred perfectly accurate information. The quantity void (QTv) was determined by subtracting the ideal quantity (Iqt), set at 11, from the perceived quantity (Pqt), reflecting the ideal balance of information. The source void (Sv) was computed by comparing the actual source of information (As) with the trusted source (Ts), as individuals were assumed to prefer information from sources they trusted. Similarly, the channel void (Cv) was the difference between the accessible channels of information (Ac) and the preferred channels (Pc), with the ideal being the channels individuals would choose under optimal conditions.

In the second step, a min-max normalisation procedure was applied to rescale the void values to a consistent range from 0 to 10, facilitating easier interpretation. This rescaling involved identifying the minimum and maximum values for each void variable and applying a formula to adjust the values proportionally. The final step involved calculating the unadjusted population means for each void, where higher values indicated a larger gap between actual and ideal information. The results were then visualised using the Flourish data visualisation tool.

Findings

RQs 1 & 2: Detecting IVs across four dimensions in Central Europe

In response to RQ1, we found that rapid pulse surveys (typically taking 5 minutes to complete) can detect information voids. The surveys typically reached 90% of our target sample within 1 hour of launch. The time and cost efficiencies associated with pulse surveys in conjunction with the robustness of our sample demonstrate the value of this methodology for detecting IVs during climate and health emergencies.

In Figure 1 below, each radial bar graph represents the void for a particular dimension. The circumference of these graphs is lined with the categories/types for that particular dimension. Each bar extends from the centre of the circle to the circumference - hence, the longer the bar, the greater the void for that category within the respective dimension. The length of each bar is thus proportional to the mean value it represents. As such, the mean values displayed below each legend only represent the overall average for that particular dimension. From a policymaking perspective, the bars pertaining to each category provide a specific insight, the size of which may require attention and intervention. For this pilot study, we define means of 1.00 - 3.99 as a *minor void*, 4.00 - 7.99 as a *moderate void*, and 8.00 - 10.00 as a *major void*. Responding to RQ2, we see moderate information voids around floods in the Central European region. Across dimensions, the channel voids are most pronounced, followed by the source voids, with quantity and quality voids being equally sized. From a regional standpoint, the modalities of dissemination - the 'how' (channel) and 'who' (source) - need more attention. In summary, these findings demonstrate that rapid pulse surveys can be used to capture actionable insights for climate emergency preparedness experts.

RQ3: Similarities & differences in IVs across countries

In response to RQ3, Figure 2 (see below) provides granular insights into patterns in IVs across Belgium, Germany, and Poland. For instance, the largest voids pertain to information channels and sources across the three Central European countries. In Poland, with the largest overall channel void, we see the longest bars for email, followed by radio, SMS and social media. From an information delivery standpoint, the gaps between how people prefer to receive flood information from and their ability to access these channels during floods are most pronounced for these categories.

Further, we see that Belgium has the most prominent means of information sources, indicating inconsistencies between trusted and actual sources of information. Across the three countries, we see a specific pattern where the longest bars pertain to emergency officials (especially in Poland, followed by Germany) and friends. We also see a difference in voids related to the federal government as an information source with the most significant void in Poland and the smallest in Germany.

The V-shapes in the top half of all the quality and quantity voids suggest that voids around the amount and accuracy of the location (where) and timing (when) of floods are the largest among all categories, with the voids being especially pronounced in Poland. Furthermore, moderate voids are information about the severity of the floods and details about the timing of evacuation plans that appear consistently in all countries. The overall means for the quality and quantity voids are the highest in Poland indicating the need for a focus on the adequacy and provenance of information. These findings align with news surrounding amplified reports of fatalities and government inaction by cross-border disinformation actors (EUvsDisinfo, 2024).

Regional Analyses

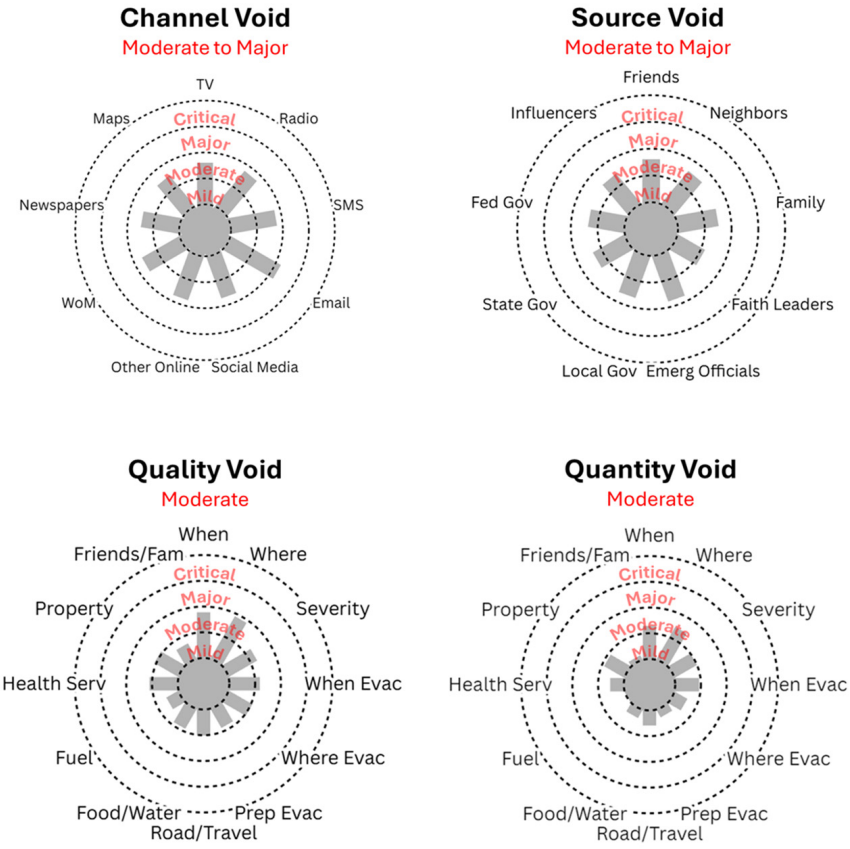

Figure 1. The radial graphs show the aggregated information voids across Belgium, Germany and Poland.

Note: Each bar extends from the center to the circumference of the circle, with the length of the bar indicating the magnitude of the void for that category. Longer bars signify greater voids. The mean values displayed below each legend provide an overall average for that dimension, helping to contextualize the data.

Country-level Analyses

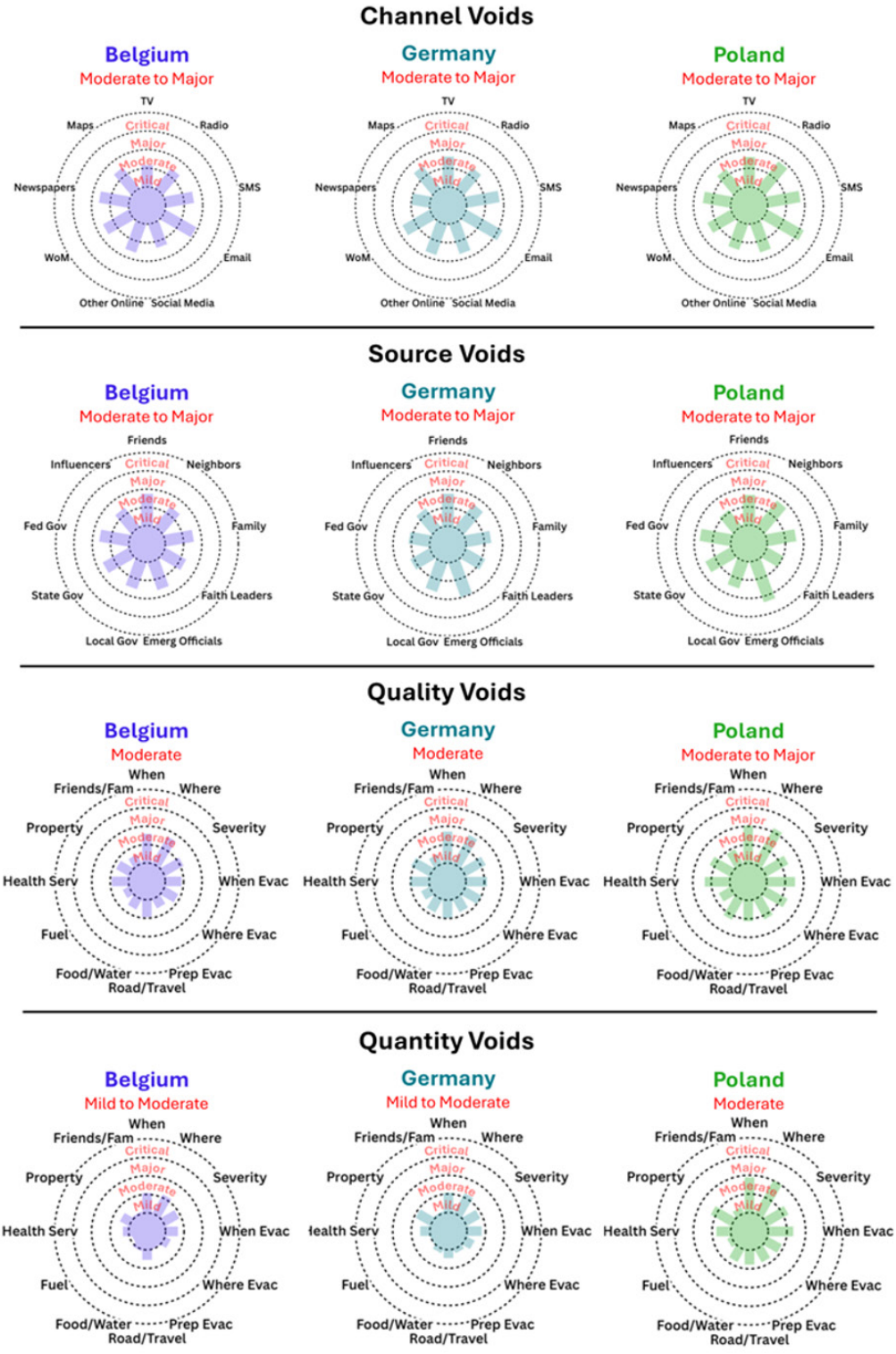

Figure 2. These radial graphs show the magnitude of information voids in each country to allow visual analyses of similarities and differences.

Implications for Emergency Preparedness

We suggest that quantifying information voids is a critical component of flood-related emergency preparedness and response and relief efforts for several reasons. First, it allows emergency managers and risk communicators to understand the nature of communication needs and the trusted and preferred modes through which risk communications may be delivered to affected populations. Second, these insights can be used to tailor and crystallise risk communication priorities in preparation for or during a flood event. For instance, some communities may express the need for more information on healthcare access vs. others who may need information about supplies. Consequently, this formulation provides a quantifiable framework that can be deployed at various stages of flood risk communication management, from preparedness to response and recovery. Third, our approach provides a starting point for crisis communication practitioners and scholars to fine-tune our model by incorporating considerations of information amplification or attenuation, influence effects of sources, and perceived affordances of different communication channels during emergencies. In future work, our findings will incorporate critical contextual factors like political orientation, climate change awareness, and vulnerability to misinformation, likely affecting perceptions around information quantity, quality, sources, and channels.

Equally, our work aims to illustrate the value of employing rapid pulse surveys to detect information voids that can serve as fertile ground for misinformation during emergencies. Positioned within the social listening spectrum, our approach bridges traditional community outreach and social media discourse analysis, both of which are increasingly integrated into emergency preparedness strategies. This methodology offers significant efficiencies in terms of time, cost, and scalability—critical factors in managing climate crises.While rapid pulse surveys have been successfully utilized in health emergencies, such as COVID-19, to assess health service utilization and vaccination uptake, our application opens new avenues for preempting infodemic outbreaks during climate-related and health emergencies. By strengthening infodemic management efforts, we can mitigate the risks associated with misinformation dissemination.

Our research underscores the necessity of understanding information voids in the context of disaster management. By identifying and quantifying these voids through rapid pulse surveys, we provide actionable insights that can enhance emergency communication strategies. Our findings suggest that targeted interventions based on identified IVs can significantly improve public awareness and preparedness during flood events. For example, the size of each bar indicates specific areas that may require attention and intervention from policymakers. For example, if channel voids are significantly larger than others, it suggests a need to enhance communication through preferred channels during emergencies.The analysis reveals moderate information voids across the region with channel voids being most pronounced, followed by source voids. Quantity and quality voids are similarly sized but less significant.

As policymakers consider integrating these findings into existing emergency communication frameworks, focusing on where information voids are most pronounced to allocate resources effectively is essential. Promoting active engagement with local communities will ensure communication strategies resonate with their preferred channels and sources.

Furthermore, designing localized training programs for emergency managers should incorporate modules on identifying and addressing information voids to enhance response efforts during crises.In the long term, establishing frameworks that continuously assess information dissemination during emergencies will allow for real-time adaptations based on community feedback. This proactive approach is vital for improving flood-related emergency preparedness and response across the Central European region, contributing to more resilient communities facing climate change impacts.

In summary, the document provides critical insights into information voids experienced during Central European floods across different dimensions and countries. Policymakers can leverage these insights to enhance communication strategies, ensuring that populations affected by extreme events like floods receive timely and accurate information during crises.

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