

COMMENTARY

What is in a number? Some reflections on disaster displacement modelling

Halvard Buhaug^{1,2} ¹Peace Research Institute Oslo (PRIO), Oslo, Norway²Norwegian University of Science and Technology, Trondheim, Norway**Correspondence**Halvard Buhaug, Peace Research Institute Oslo (PRIO), Oslo, Norway.
Email: halvard@prio.org**Funding information**

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Abstract

The rise in global displacement has inspired a wave of quantitative comparative research in recent years. While deeper systematic knowledge on contextual determinants of disaster-related mobility and associated risks is in high demand, quantitative modelling of human displacement should be exercised with care. In this commentary, I reflect on three central challenges related to the quality of available displacement statistics. Future scientific progress in this field would benefit tremendously from harmonization and validation of displacement data that separate between distinct mobility responses.

INTRODUCTION

Global displacement is at an all-time high (UNHCR, 2022a). More than two-thirds of all internal displacements are driven by extreme weather events, notably floods and storms (IDMC, 2022). Since 2012, geophysical and weather-related disasters have been responsible for 230 million internal displacements, indicating the scale of the phenomenon at hand.

The rise in human displacement has motivated new quantitative analyses of, inter alia, flood-induced displacement (e.g. Vestby et al., 2023), conflict-driven mobility (e.g. Schutte et al., 2021) and scenario-based projections of future displacement (e.g. Rigaud et al., 2018). Despite significant methodological progress and immediate policy relevance, this research is not without limitations. In this commentary, I briefly reflect on three reasons why macro-level quantitative modelling of displacement remains challenging and why results from such studies should be interpreted with care. I discuss these concerns within the scope of disaster displacement, although several points raised below will be relevant for quantitative research on human mobility more generally.¹

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QUALITY OF DISPLACEMENT DATA

The first and most obvious concern is the varying quality of aggregate displacement statistics.² One reason for this is the absence of a clear and universally accepted definition of displacement (Gemenne, 2011). Conceptual opacity causes uncertainty as to what might be reasonable minimum requirements for displacement in terms of distance and duration of relocation and degree of involuntariness, as well as whether pre-emptive mobility should be included. Given this uncertainty, sources are bound to vary in how they understand and register human displacement.

Access to reliable information also varies across locations, shaped by logistical, as well as political barriers and the presence (or not) of governmental, humanitarian, media and other monitoring agencies. Certain actors might have an interest in inflating or deflating the gravity of a crisis, and early guesstimates sometimes become established facts. Even well-documented disaster events can generate inconsistent information. For example, writing on the 2022 Pakistan floods, Islamic Relief (2022) reported that 2.1 million people lost their homes—a common proxy for displacement. Contemporaneous estimates by the UNHCR (2022b) indicated that around 7.6 million people were displaced by the floods, whereas 33 million people were affected. Other sources, including *The Guardian* (Baloch, 2022) and *Nature* (Mallapaty, 2022), relied on the latter figure, reporting that the Pakistan floods had displaced 33 million people.

Indirect estimation of displacement through, for example, tracking of mobile phone data (Arai et al., 2022) or remote sensing of inundated or destroyed settlements (Ratnayake et al., 2022) can be useful complementary information-gathering strategy, especially in data-sparse contexts. However, the merit of such approaches is sensitive to the quality of underlying demographic data and modelling assumptions. There is also a challenge of attribution, especially for mobility in response to compound events (e.g. flood and conflict) and during slow-onset hazards such as drought, and it is sometimes not possible to separate confidently between displacement and regular migration.

For these reasons, available displacement statistics suffer from uncertain, inconsistent, inaccurate and incomplete estimates about the driver(s) and magnitude of disaster-related mobility. While providers of displacement statistics are aware of this problem (see IDMC, 2020), the implications for how statistical modelling of displacement should be conducted, inferred and communicated to end users deserve more attention.

GOOD VERSUS BAD DISPLACEMENT

Human mobility is complex; even rapid-onset disaster displacement is affected by factors beyond hazard severity and degree of exposure, often in nonlinear, context-dependent ways. Capturing such dynamics in an aggregate statistical framework is demanding.

A less frequently acknowledged challenge to quantitative modelling of displacement concerns the mode of mobility, where a central divide runs between anticipatory action and postdisaster impact. High-capacity societies may have a preference for inclusive pre-emptive evacuation to minimize loss of life to forecasted hazards. On 28 October 2012, 375,000 residents in New York City were ordered mandatory evacuation before landfall of Hurricane Sandy, of which around 37%—nearly 140,000 persons—complied (Brown & Parton, 2014). In less capable or well-functioning societies, hazard-related mobility is likely to be dominated by postdisaster displacement. The overall magnitude of displacement may be comparable in these cases, but the manner in which it occurs and the implications for individuals' agency, safety and well-being can differ widely.

Displacement is disruptive by definition and may reflect a failure of adaptation to environmental change (Black et al., 2013). Even so, it can be considered 'good' when it saves lives and reduces risk. Unfortunately, current displacement databases do not enable separating between pre-emptive evacuation and displacement that occurs as

a consequence of material destruction, making it difficult to identify statistically robust societal features that are associated with reduced risk of 'bad' displacement.

DEFICIENT DISPLACEMENT

A third analytical challenge concerns the invisible disaster victims. This includes so-called trapped populations (Foresight, 2011), who are prevented from moving due to the lack of opportunities or means of mobility, as well as people who individually or collectively choose to stay in the face of disaster due to faulty or incomplete information, high-risk acceptance, cultural factors or strong attachment to place (Adams, 2016). Such involuntary or maladaptive immobility may be thought of as 'deficient displacement' in that it entails higher risk exposure than conceivably would have been the outcome under mobility.

Deficient displacement is hard to foresee. The difficulty of accounting for real and perceived barriers to mobility in a quantitative analytical framework increases the potential for false positives, where models overpredict the number of people displaced by a hazard. A high rate of fatalities to displaced or a low displacement-to-exposed ratio could be indicative of widespread deficient displacement, but these would certainly not be precise metrics. As mentioned, the 2022 Pakistan floods reportedly affected around 33 million people but less than one-quarter of these relocated due to the flooding (UNHCR, 2022b). Does that mean that the 25 million affected people who did not move were able to cope well in situ? Or does that figure also include a large number of people whose inability or unwillingness to flee put them at greater risk? We still have a limited scholarly understanding of the processes and outcomes of this phenomenon, let alone rigorous data to answer such questions.

CONCLUDING REMARKS

So, what are the implications of these modelling challenges? A key long-term priority should be to enable harmonizing data collection across displacement categories and events and validating historical displacement estimates with up-to-date information against a common set of coding criteria. However, the challenges discussed here also offer insights of immediate relevance to stakeholders across the science-policy divide:

1. Be careful when conducting, interpreting and communicating statistical analyses of aggregate displacement data. Available data sets suffer from inconsistencies and inaccuracies due to a lack of uniform reporting and coding routines, implying that comparisons across events and over time should be exercised with much care. Researchers have a particular responsibility to be transparent about measurement uncertainty and the sensitivity of results to shifting data samples.
2. Avoid framing the number of displacements as an indicator of disaster severity. Even though displacement is disruptive, it also is an essential coping mechanism. Global disaster mortality rates have fallen steeply in recent decades (Formetta & Feyen, 2019). This is evidence of important progress in reducing vulnerability to natural hazards, even if (or partly because) disaster mobility shows an upward trend.
3. Do not forget the invisible disaster victims. At present, we lack systematic data on people exposed to extreme events who fail to flee due to inability or choice, although this group includes some of the most vulnerable people. A low rate of displacements to exposure may be indicative of high coping capacity, but it also could reflect material, cognitive or contextual barriers to mobility that increase the human cost of disaster.

The Sendai Framework for disaster risk reduction is a cornerstone in the international community's work toward sustainable development. Reducing the number of people affected by disaster is an essential part of that objective. However, reducing vulnerability to natural hazards does not necessarily imply a decline in displacement

rates, but rather that hazard-related mobility is prepared and managed and thereby contributes to reducing disaster risk.

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PEER REVIEW

The peer review history for this article is available at <https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/imig.13165>.

DATA AVAILABILITY STATEMENT

This commentary does not contain empirical data.

ORCID

Halvard Buhaug  <https://orcid.org/0000-0002-6432-5985>

ENDNOTES

- ¹ Disaster displacement is here understood as persons who are forced or obliged to flee or to leave their places of residence as a result of or in order to avoid the effects of natural hazards (UN., 1998).
- ² Relevant data sets include the Global Internal Displacement Dataset and the Global Flood Database.

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