# Alternative Data Sources for Impact-Based Forecasting and Warning Systems for High Impact Weather

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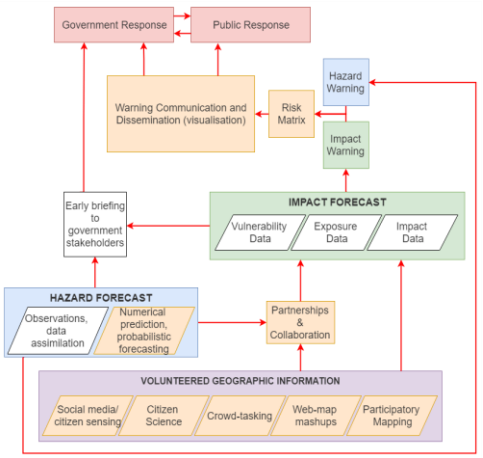
## Introduction

With the global rise in high impact weather (HIWeather) events, the World Meteorological Organization (WMO) is advocating for nations to adopt risk-based communication to describe not only what the weather hazard will be, but also what it will do to vulnerable people, property, and infrastructure.

Availability of, and access to, impact, vulnerability, and exposure data before, during, and after an event are key challenges to building impact-based forecasting and warning (IBFW) systems. To generate these data, collaboration and partnerships with various stakeholders are necessary; their role in the IBFW framework is demonstrated in Fig. 1.

Volunteered geographic information (VGI) has become increasingly important in disaster risk reduction (DRR), primarily in the during and response phases [1]. However, it has potential as a collaborative process for improving risk communication [2]. Information and knowledge possessed by citizens can uncover "areas of importance or concern" that have yet to be identified in an official capacity [3, p. 40]. Furthermore, sharing information with and between citizens and officials fosters trust and social capital within communities, leading to increased resilience [4], [5].

**Fig. 1 Impact-Based Forecast and Warning System Framework with VGI integration**




Adapted from [6]

**Table 1. Examples of partnerships and collaborations needed to develop IBFW systems**

| Stakeholder partnership | Information/data sharing |
|---|---|
| **Local and central governments** | Evaluate vulnerabilities, identify potential and actual impacts and proper mitigation actions, share expertise, develop plans, structures, guidance |
| **Scientific institutions** | Improving and developing technical processes/equipment (e.g. modelling), sharing data sources/datasets, share expertise |
| **Local communities** | Identify thresholds, vulnerability, and exposure |
| **Economic sectors** | Identify thresholds, vulnerability, and exposure |
| **Insurance/Re-insurance** | Vulnerability of physical infrastructure, impact data collection |
| **Media** | Identify potential impacts, communicate information to and from public |
| **Non-governmental organisations (NGOs)** | Vulnerability and exposure assessments, mitigation actions |

## Purpose & Research Questions

The aim of this study is to investigate how online engagement and participatory platforms supported by volunteered geographic information can boost IBFW systems for HIWeather through facilitating collaboration between stakeholders, while providing a novel way of gathering and creating impact, vulnerability, exposure, and hazard data. The following research questions will guide the study:

- How can impact, vulnerability, exposure, and hazard information gathered from VGI be introduced into IBFW systems and impact modelling as a data source and as a collaborative process?
- What hazard, vulnerability, exposure, and impact data can be gathered from VGI to inform impact warnings?
- How can VGI facilitate partnerships between agencies to aid in the development and implementation of an IBFW system?
- What are the challenges and risks of introducing VGI into IBFW systems and how can they be overcome?

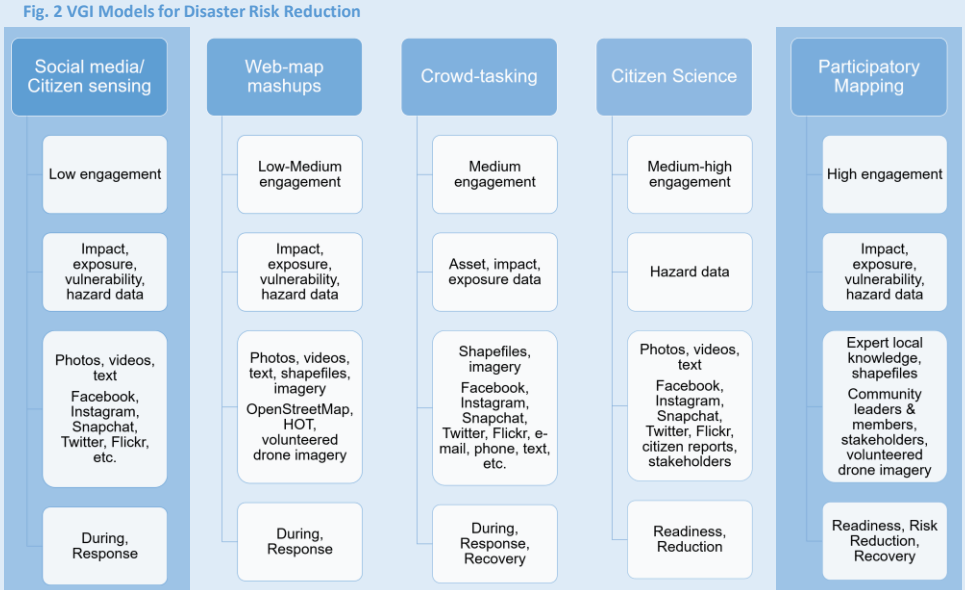
## Methods

Qualitative participatory methods will be applied to explore the selected VGI models from Fig. 2 (citizen sensing and participatory mapping) to determine which method best fits into each stage in the IBFW system (e.g. modelling, forecasting, warning, verification).

Participants will consist of the various stakeholders that are needed for a successful IBFW system, such as national hydrometeorological services, civil defence services, natural resource sectors, infrastructure sectors, and the public (Table 1).

These participatory methods will provide an opportunity to form the required partnerships for information gathering and sharing that are required for the sustained success of an IBFW system.

**Fig. 2 VGI Models for Disaster Risk Reduction**

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