Photo: destruction of houses after Cyclone Idai, Mozambique, March 2019 by Denis Onyodi/IFRC-DRK-Climate Centre.

Improved data to better understand exposure, vulnerabilities and hazards

SHEAR research outcome

Data plays a key role in preparing for, and responding to, disaster risks. With improved quality, availability and accessibility of hazard-related data, disaster impacts can be better defined and anticipated. This brief explores key improvements in data delivered by SHEAR projects.

Summary

The quality and accessibility of data underpins efforts to better monitor and anticipate potential hazards. However, in many of the countries where SHEAR worked, data availability is limited.

SHEAR projects have developed new approaches to collect, analyse and update data to bridge these gaps, through employing unconventional data collection methods such as citizen science and using smartphone imagery.

By analysing historical data, several SHEAR projects have contributed to improved understanding of the climatic conditions, hazard patterns and impacts, which in turn informs the development of warning systems for future events.

Introduction

Improving the quality and coverage of hazard and climate data can help practitioners and policymakers to understand when and where hazards are likely to occur, how severe they will be and what impacts they will have. Scientific research can enable the closing of data gaps, providing stakeholders across sectors with the information they need to take early and effective action to reduce the impacts of natural hazards.

Projects in the Science for Humanitarian Emergencies and Resilience (SHEAR) programme have been working across contexts to improve datasets relating to a range of hazards, including droughts, floods, landslides and tropical storms. The programme has shown how better quantification of historical hazard events and impacts can be integrated with new data on current conditions and improved modelling of future projections, to enhance disaster preparedness and response. Throughout, part of the mandate of SHEAR was to ensure the sustainability of the methods and support capacity development of local partners to continue with these methods beyond the timeline of the programme. Projects strove to create accessible and open-source data wherever possible.

Collecting and monitoring climate data for forecasting and early warning

Monitoring and modelling are two key components for the generation of forecasts which provide accurate and detailed information about likely weather and climate events that decision-makers need. Observing environmental conditions over time enables forecasters to identify and understand patterns in the climate, weather and hydrology. In turn, improving the quality, availability and accessibility of this weather data enables key stakeholders to plan for and respond to hazards, particularly in highly vulnerable regions.

In many contexts where SHEAR worked, monitoring and modelling were limited by a lack of available resources for the installation, maintenance, operation and application of equipment and/or a lack of underpinning data. SHEAR projects have developed knowledge and tools to support data collection to bridge these gaps. As such, SHEAR projects have developed innovative, practically applicable and sustainable technologies to collect and manage monitoring data for different hazards, facilitating early warning and early action for disaster risk management.

About SHEAR

The SHEAR programme (Science for Humanitarian Emergencies and Resilience) carried out innovative research, in some of the most hazard-prone parts of the world, to better understand and forecast disasters, and minimize the risk they pose to vulnerable communities.

SHEAR cutting-edge research aimed to enhance the quality, availability and use of risk information and early warning systems.

SHEAR research brought together the unique knowledge and skills of stakeholders in physical and social sciences, disaster risk management practice, and policymaking. Effectively managing this range of expertise enabled SHEAR to deliver holistic cross-disciplinary, high-impact work on disaster risk and resilience.

For further information please see the SHEAR Knowledge Product Directory.

Addressing the data gaps for monitoring include the use of unconventional data collection, for example, through smartphone imagery and other citizen science approaches. Landslide Environmental Virtual Observatory (LEVO), for instance, has been working with communities and schools to monitor rainfall using citizen science approaches, addressing critical data gaps for landslide warnings. Meanwhile, Mitigating Basis Risk project has been working with farmers and financial service providers in India and East Africa to use smartphone imagery and citizen science data collection methods, combined with satellite data, to support localized crop modelling and loss assessment. This monitoring data is then channelled into the design of insurance products that are based on accurate information about the losses incurred by farmers so that pay-outs in the event of a weather shock are more reliable and timelier, and better meet the needs of smallholder agricultural producers.

Hazard and risk data from modelling systems can support many aspects of risk management decision-making. SHEAR modelling data cover a range of hazard types under both present data and future environmental scenarios. For instance, Across Botswana, South Africa, Mozambique and Zimbabwe, CONNECT$_4$ Water Resilience monitored the impact of flood-related rapid dam filling on the levels and quality of water resources for downstream communities, supporting the improvement of water reservoir management to reduce the risks of water contamination and shortages.

Analysing historical climate data to better understand patterns and trends

Understanding the historical climate conditions and hazard events in a given area are key components in understanding how future hazards may affect a population. Together with historical data on vulnerability and exposure, this can identify links between certain conditions and the likelihood of a disaster occurring, or can determine patterns and trends and how these are developing or changing over time.

- The Coastal Ecosystem Recovery Financing for the Future (CERFF) project used historical data on coral reef degradation in Grenada to refine models of the effect of coral reefs in reducing the height and energy of waves associated with tropical storms.
- SHEAR-funded responsive research after the 2015 Gorkha Earthquake in Nepal focused on mapping, monitoring and modelling 18,000 earthquake-triggered landslides. The outputs have been used to assess current and future landslide risk for 1.2 million households across Central and Western Nepal.

SHEAR projects have been working in a range of contexts with diverse stakeholder groups to develop historical data for different hazard types, supporting forecasters and disaster risk managers to interpret and act on this information. In India, the LANDSLIP project analysed daily weather patterns in 1979–2016, identifying rainfall conditions that correlate with a higher incidence of landslides. This historical data can now be used by the Geological Survey of India – a key project partner and the government agency mandated with monitoring and issuing warnings of landslides – to identify weather conditions that may lead to a greater risk of landslide events.

Further example: Addressing an identified problem

Flash floods in the Sahel region of Africa have tripled in frequency over the last 35 years, driving an urgent demand for actionable information, which this impact data makes possible. For example, the Nowcasting Flood Impacts of Convective Storms (NFLICS) project developed a Flood Impact Database which ANACIM (Senegal's national agency of civil aviation and meteorology) forecasters will use to inform their flood impact forecasts, enabling humanitarian responders and civil protection authorities to access advance warnings of heavy rainfall and the likely impacts of floods.

Linking climate with impact data to inform decisions

Information about the impacts that disasters have across communities and sectors is vital in effective disaster risk management and response. Quantitative and qualitative data on the types of impacts that are likely to occur, and the factors that will influence impacts, are essential to enable decision-makers and practitioners to plan and deploy the appropriate resources when and where they will be most needed and most useful.

As well as focusing on these sudden onset hazards, SHEAR examined the impacts of slow onset disasters. For example, the Drought Risk Financing Science Laboratory (DRiSL) project developed a database of drought impacts in Madagascar, Pakistan and Zimbabwe to understand the ways in which drought affects the lives and livelihoods of populations. This evidence-base of experienced impacts provides practitioners and decision-makers with valuable information and guidance as they design and implement their contingency plans. In this way, anticipation of and response to drought can be based on actions that are relevant to the needs of people whose lives and livelihoods are affected.

Conclusion

The complexity of working with data to reduce disasters is evident. However, it is increasingly important to address data gaps and harness available information to address the growing and more complex systemic risks that countries face. Better data provision, and better understanding of this data across sectors, is key to reducing disaster risk. SHEAR has driven this agenda and made great advances to enhance the use of data among disaster risk reduction practitioners. A strong understanding of the underlying vulnerability, which is often the most complex element of risk reduction, has made a strong difference in SHEAR projects – for example, the work on drought impacts on lives and livelihoods in the DriSL project.

It is clear that there continues to be huge data gaps in many regions of the world, that limit the disaster risk reduction efforts of practitioners and governments, especially with regards to preparing, preventing and mitigating the impacts of natural hazards. Academic research has a central role to play in filling these gaps, gathering historical data on weather and climate and, notably, on the impact of extreme weather as well as monitoring current conditions, with a full understanding of exposure and vulnerabilities in local contexts. This will allow all stakeholders to better understand risks and enhance decision-making, procedures and systems that can reduce risks and save lives and livelihoods.