DRR: a commentary on data, science and risk assessment (Chapter 4)

There are three areas where science can contribute substantially to DRR, namely early warning, risk assessment and integrated assessment of disaster data. These topics relate to the several of the identified challenges under the section 3 on "Target-setting levels and monitoring" and to the goal of "By 2030, significantly reduce the number of deaths and the number of people affected and decrease by [x] per cent the economic losses relative to gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations". Here some key issues are discussed, largely informed by work to provide a synopsis of global volcanic risks for GAR15. However, most of the issues raised here are relevant to a much wider range of natural hazards.

Data. A fundamental requirement for almost all these challenges is the quality, quantity and accessibility of data. To set targets it is implicit that one already knows what the baseline numbers of deaths, people affected and economic losses are. Similarly models for forecasting (early warning and planning) and for hazard and risk assessment in probabilistic constructs require robust data to inform largely empirical hazard and risk models. Much of the critical information and data to set targets and assess risk is incomplete, missing, of poor quality, characterised by large uncertainties and often inaccessible. There needs to be a major international effort to fill data gaps, improve the quality of data and make the data available in forms that are useful to DRR. Resources at local, regional and international levels need to be applied to collecting data where there are gaps, creating robust relational databases, developing tools for the intelligent analysis of data and providing platforms to access to the data and tools. Historical data are very valuable but contain many biases, uncertainties and pitfalls in their analysis. Without care in the analysis such data can be misleading and lead to false inferences. An evidence-based approach requires great attention being paid to the quality of data and attendant uncertainties. A final concern is the quality of data analysis. While UN ISDR have rightly adopted an evidence-based approach, standards of analysis and understanding of statistics within parts of the DRR community are poor, leading to problematic interpretations.

Modelling and probabilistic scenario modelling. Forecasting of natural hazards through development of models is a critical part of the input of science to DRR. Many of these models are either purely empirical or semi-empirical which means that the quality and plausibility of models is strongly dependent on the quality of the data and the analysis of data. They are also dependent on the basic understanding of natural hazards processes and it is here that the natural sciences have the most significant impact. For risk analysis the uncertainties in vulnerability are likely to even greater than the uncertainties in physical parameters. Probabilistic scenario modelling has become a dominant approach to hazards and risk assessment. With increasing computer power and speed its seems likely that there will be some significant advances There will be a move away from specific scenarios to a spectrum of scenarios that are based on an understanding of the distribution of potential scenarios. The interactions of multiple hazards and their cascading effects on the environment and society can be simulated. In my view judging from drafts of GAR15 and listening to sessions at conferences there is a dangerous over-reliance by the DRR community on model outputs.

Assessing risk. Risk is commonly defined as a loss. However, in a disaster there are many different kinds of loss (e.g. loss of life, loss of livelihoods, economic losses, loss of critical infrastructure, loss of habitats). Risk means something different for each kind of loss and some risks are more easily quantified than others. Arguably a failure of contemporary discourses on risk is nit to adequately articulate different forms of risk. There is also a tendency within the DRR community to assess risk for facets of risk that can be easily quantified. For example it is relatively straightforward to assess the spatial distributions risk of building damage for earthquakes. Thus probabilistic maps of spatial parameters of hazard and risk will be highlighted. In many emergencies, however, risk varies with time and includes important kinds of risk, which are not so easily quantified. The dynamic nature of risk and the complexity of multiple forms of risk need to be recognised within the new framework.

Climate change, demographic changes and urbanization. I am glad to see that major influences on disaster risk other than climate change are being highlighted. One aspect of disaster risk that has not yet been exploited is the fact that earthquakes and volcanic eruptions are not affected by climate change in terms of rates of events. Thus a way to disentangle the historic role of climate change relative to the role of demographic changes and urbanization would be to compare these geophysical hazards with hydrometerological hazards with respect to impacts and losses. Climate change clearly is of great concern but should not be given undue weight in considering changing factors that adversely affect risk. There are other major factors influencing vulnerability to natural hazards not captured in the title, such as environmental changes (which is not the same as climate change), effects globalisation and the effects of conflicts.

New solutions for measuring. There are some very exciting opportunities for improving data, data analysis and introducing new kinds of data to inform and support DRR. Accessibility and capacity to use such data and apply new technologies remain major issues in some resource-poor countries. Investment in scientific infrastructure, the skills of scientists and technical staff institutions and the long-term maintenance of technical facilities and equipment are paramount to the successful deployment of new technology and forms of data. International sharing of data, open access to data and platforms to enable access to data and analytical tools for data analysis need to be promoted and developed further.

Other issues. DRR is commonly framed by nation states, but many natural hazards cross borders and extreme events can affect many different countries and can even have global impact. There is increasing need for closer regional and international collaboration to address DRR. Mechanisms for such collaboration are emerging but the existing structures for scientific and technological collaboration, developed many decades ago, are inadequate. Funding of science is mostly national and occasionally regional (e.g. the EU), but is not fit-for-purpose in the contemporary globalised and interdependent world.

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7th February 2015