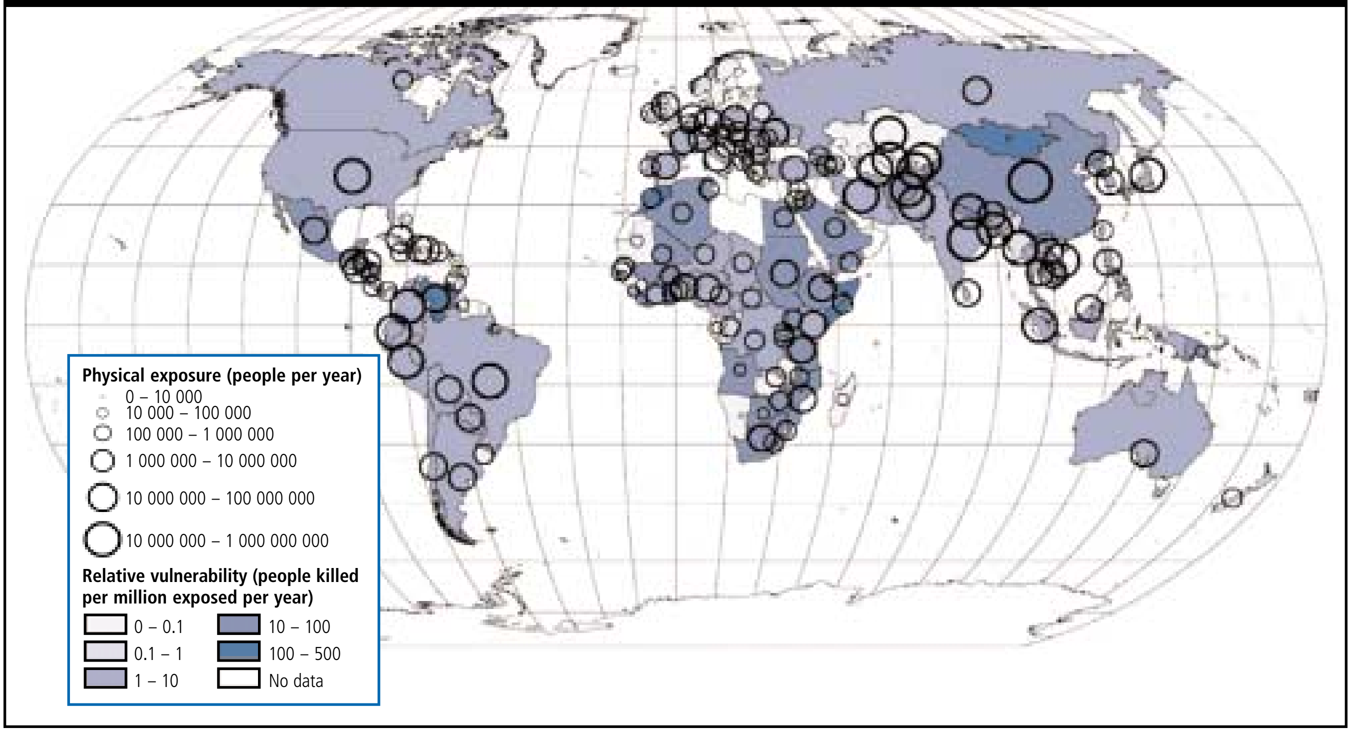
FIGURE 2.14 PHYSICAL EXPOSURE AND RELATIVE VULNERABILITY TO FLOODS, 1980–2000



Source: Université Catholique de Louvain: The EM-DAT The OFDA/CRED International Disaster Database (victims); U. S. Geological Survey: HYDRO1k Elevation Derivative Database (flood affected watersheds); CIESIN, IFPRI, WRI: Gridded Population of the World (GPW), Version 2 (population); Compilation and computation by UNEP/GRID-Geneva

The use of mortality as an indicator of vulnerability to floods could be supported by case specific information on losses to agricultural production, to housing and to social and economic infrastructure, which might be incurred without necessarily causing a large loss of life.

Taking into account and clarifying these different limitations, Figure 2.13 does show a range of countries, particularly in Africa and Asia, with higher human vulnerability to floods than countries such as Germany and the United States of America.

As in the cases of earthquakes and cyclones, there was a strong association with *physical exposure.* With floods this variable was tied to GDP *per capita,* which was inversely correlated with recorded deaths. There was a negative correlation between deaths from flooding and *local density of population*

Countries with low GDP per capita, low densities of population and high numbers of exposed people were most at risk from flood.

These indicators identify pathways into vulnerability to floods. The next stage of assessment would be to explore the detailed relationships that allow this to take place. This is partly the aim of Chapter 3.

Intuitively, one could expect mortality from floods to be high in countries with sparsely populated, poor rural areas, where disaster preparedness and early warning is non-existent and where health coverage is weak and not easily accessible. In such areas people would have less possibility to evacuate from flood prone areas and would be more vulnerable to death through flood related diseases.

Figure 2.14 presents a map of physical exposure and relative vulnerability to floods.

2.3 Unpacking Global Risks

In the first section of this chapter, the DRI was used to demonstrate the ways in which development constructs differential and heterogeneous risk patterns between countries at the global level. At a national level of observation and a local level of resolution, risk and vulnerability exhibit similar patterns of variance and heterogeneity, meaning that different regions and localities within a country are more risk-prone than others.

As was emphasised in Chapter 1 and will be explored in more detail in Chapter 3, risk is configured historically

BOX 2.2 NATIONAL DISASTER DATABASES

This box presents three initiatives for national level data collection.

The Latin America DesInventar

This methodology was initiated by the Network for Social Studies on Disaster Prevention in Latin America (LA RED) in 1994. It seeks to record all discrete events that have resulted in adverse effects on life, property and infrastructure triggered by natural and man-made phenomena and geo-referenced to the smallest available political-administrative unit in a given country — usually the District or Municipality. By collecting disaggregated data, DesInventar enables the recording of individual localised small-scale disasters as well as the impacts of large-scale hazard events at the local level.

National level DesInventar disaster databases, with up to 30 years of data, have been developed to date in 17 countries in the Americas. These are Argentina, Chile, Peru, Ecuador, Venezuela, Colombia, Panama, Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala, Mexico, Dominican Republic, Trinidad and Tobago, Jamaica and Guyana. Sub-national databases have been developed for the Departments of Antioquia and Valle del Cauca and for the city of Pereira in Colombia and for the State of Florida in the USA.

Local disasters with very limited direct impacts are included (e.g. the destruction of one house or a household affected by the loss of their harvest as a result of a frost), as well as those with more widespread impacts (e.g. earthquakes affecting metropolitan districts). These databases have been developed by national governments, international organisations, universities, scientific organisations and Non Governmental Organisations (NGOs). Data is obtained from the media and government agencies and existing databases. Once collected, data is verified nationally for consistency. Shared definitions are used for some key hazards, while for others local specificity is more important. The challenge of uniformity between the databases remains, limiting the capacity for international comparisons.

The Orissa Experience

In 2002, UNDP set about producing a database including an inventory of disaster events with a natural trigger for Orissa. The aim of the project was to develop a tool to help decision-makers prioritise expenditure in an objective manner. Orissa is to act as a pilot with the next stage, including replication in an additional four Indian states and integration into a national Government of India Integrated Disaster Resource Network. The methodology was modified from the experience of the Latin America DesInventar.

News media and government sources of information are used to build up the disaster events database. A historical database going back to 1970 has been collated and is updated weekly. Before data is entered, it has to be cleaned to enable a comparable analysis. For example, when a source measures disaster impacts in the number of families, this is recorded in the database as 'people impacted' by including six people for every family. Events are standardised so that similar events like cyclones and hurricanes are classified as cyclones, with whirlwind and tornado being recorded as gales. A new event 'boat capsize' was created.

Different data sources were given different data categories to enable reviews on structural differences in the reporting format used by the press (where there is much variation between individual reporting styles and events) and government sources (which are very comprehensive but formally structured). A particular constraint has been the unequal coverage of Orissa by data sources. The media, for example, does not cover Western Orissa as thoroughly as Coastal Orisa.

MANDISA: South Africa

The programme for Monitoring, Mapping and Analysis of Disaster Incidents in South Africa (MANDISA) is a core activity for the Disaster Mitigation for Sustainable Livelihoods Programme of the University of Cape Town (DiMP). MANDISA was initiated as a pilot study in the CMA (Cape Town Metropolitan Area) in the Western Province of South Africa from 1990-1999. The methodology was inspired by DesInventar, but has been adapted for the South African context.

MANDISA focuses on South African-relevant losses including large urban 'non-drainage' floods, wildfires and extreme wind events, as well as highly frequent 'small' and 'medium' fires. Socio-economic and environmental risk factors that affect disaster impact are included where possible, allowing the potential for tracking the developmental conditions that prefigure disaster. While newspapers formed one source of information for tracking disaster events, the South African experience indicated that these provided limited insight into the highly recurrent 'small' events that occur in informal settlements reflecting only 649 of the 12,300 total incidents tracked through a thorough review of twelve different data sources, including incident reports from Fire Services, Social Services, the South African Red Cross Society and Disaster Management agencies.

MANDISA is viewed as an approach rather than a disaster tracking IT tool. This requires multi-agency cooperation, consultation and feedback, active sourcing of emergency and disaster information, strategic consolidation of information across agencies and robust geo-referencing. MANDISA is an internet-accessible database. This is intended to encourage local ownership as well as provide on-line information for schools, researchers, planners and disaster management personnel.

Source: Latin America DesInventar: http://www.desinventar.org/desinventar.html; Orissa: http://www.undp.org.in/orissa/; Mandisa: http://www.egs.uct.ac.za/dimp/

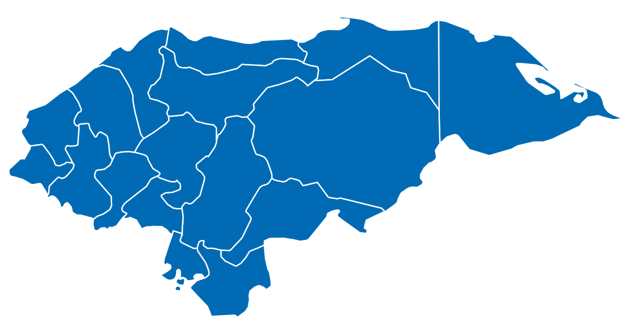
through the linked processes of economic development and environmental change, such as urbanisation and global climate change. Each risk scenario at the local level represents a unique configuration of hazards and vulnerabilities in the context of broader processes of development at the national and global levels. But ultimately, vulnerability and risk are manifested at the local level.

It is hoped and expected that the DRI is useful to illustrate global level risk and vulnerability patterns and to advocate for development policies and practices that contribute to disaster risk reduction.

However, for this sea change in development culture to take root, national governments have to adopt appropriate development policies in the context of the more detailed and complex patterns of risk and vulnerability that exist within each country.

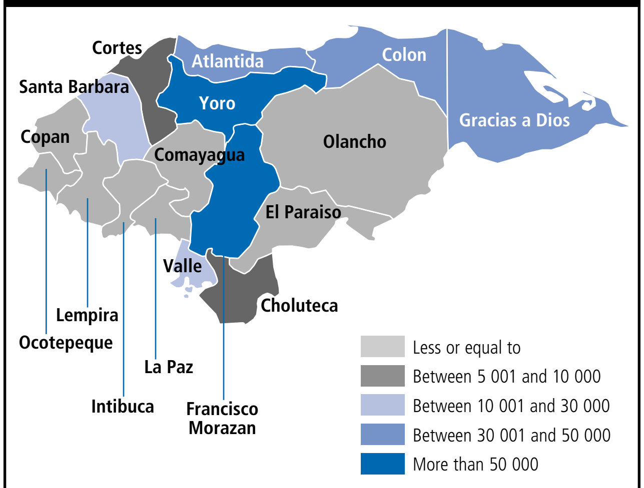
In this section of the Report, we will illustrate some of the complexities of risk at the sub-national level through a number of examples.

FIGURE 2.15 NUMBER OF HOUSES DESTROYED BY HURRICANE MITCH IN HONDURAS (GLOBAL OBSERVATION AND NATIONAL RESOLUTION)



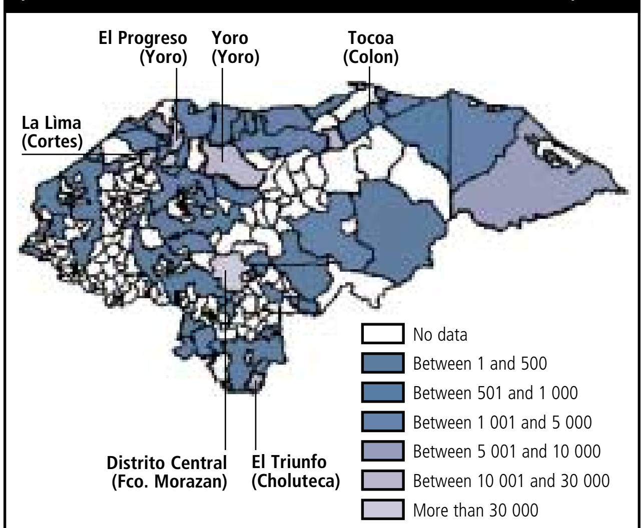
Source:COPECO-La Red, DesInventar-Mitch[5]

FIGURE 2.16 NUMBER OF HOUSES DESTROYED BY HURRICANE MITCH IN HONDURAS (NATIONAL OBSERVATION AND DEPARTMENTAL RESOLUTION)



Source:COPECO-La Red, DesInventar-Mitch[5]

FIGURE 2.17 NUMBER OF HOUSES DESTROYED BY HURRICANE MITCH IN HONDURAS (NATIONAL OBSERVATION AND MUNICIPAL RESOLUTION)



Source:COPECO-La Red, DesInventar-Mitch[5]

2.3.1 Risk patterns at the national and local levels

The DRI has been developed with a global level of observation and a national level of resolution. It allows the analysis of comparative risk levels between countries. This perspective can be complimented by viewing risk from a national level of observation and a local scale of resolution. When this is done, complex local risk patterns become apparent that are hidden at the global level.

National disasters are composed of multiple local disasters

Examined at the national level, large-scale disasters have a complex and heterogeneous impact on both territory and social groups. In this case, large-scale, national disasters may appear represented as a large number of small-scale disasters associated with a particular hazardous event. Box 2.3 explores this issue further with data from Hurricane Mitch in Honduras. The data was collected using the Latin America DesInventar methodology (See Box 2.2 on the previous page) by the National Commission for Contingencies (COPECO) of the Government of Honduras. In this case, what appears from the global level as a single, national scale disaster, takes on completely different characteristics seen with a national level of observation and a local level of resolution. This *bottom up* vision of the impact of Hurricane Mitch in Honduras clearly illustrates that risk and vulnerability patterns are locally configured.

BOX 2.3 MITCH: ONE DISASTER OR MANY?

The nested quality of disaster, where large-scale events identified at the global scale can also be interpreted as a collection of localised and small- or medium-scale events, is illustrated by the experience of Hurricane Mitch in Honduras, 1998.

Figure 2.15 represents a vision of Mitch from a global level of observation and a national level of resolution. Simply, a large number of houses were destroyed by the hurricane at the national level. Figure 2.16 moves to a national level of observation and a departmental level of resolution. At this level of resolution, widely differing impacts can already be observed between different departments. While a large number of departments had less than 5,000 houses destroyed, two departments had more than 50,000 houses destroyed. In Figure 2.17, the resolution is increased to the municipal level revealing yet another pattern of impact. While two municipalities suffered more than 30,000 destroyed houses (El Progreso in the Sula Valley and the central district of Tegucigalpa), a large number of municipalities in the country did not report destroyed houses at all.

Source:COPECO-La Red, DesInventar-Mitch[5]

BOX 2.4 TRACKING RISK THROUGH TIME HIGHLIGHTS THE IMPORTANCE OF CONTEXT AND CULTURE

The Orissa database points to epidemics as the greatest cause of deaths and fire as the greatest cause of property destruction in the state (see Figures 2.18 and 2.19). It is possible that epidemics will follow floods and cyclones so that the picture is a little more complicated than it might first appear. However, the recording of high death counts as losses to epidemics, does show the importance of indirect losses, compared to direct losses recorded from drowning or injury from a flood or cyclone. Epidemics following floods or cyclones and house fires are preventable. Their occurrence indicates high human vulnerability and a lack of adequate planning.

From the Orissa database it became evident that despite an underlying increasing trend in the number of reported fire events for the state, damage to property due to fire was declining (Figure 2.20). It is thought that this is because of increasing urbanisation, which marks a change from traditional and flammable construction materials towards a preference for houses constructed from concrete.

Some preliminary data also suggest a higher level of risk in some highly populated coastal areas. The concentration of people and risk into a small number of coastal districts shows the importance of sub-national studies for building up accurate pictures of risk that are hidden at the national or regional level.

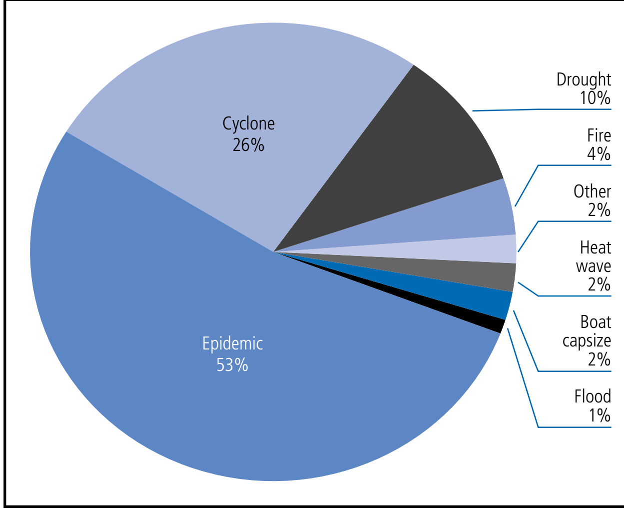
Source: UNDP India, preliminary results of Orissa DesInventar database

Each municipality in Honduras represented a particular configuration of hazards and vulnerabilities with respect to the housing sector, irrespective of the fact that the natural phenomenon itself (Hurricane Mitch) affected more or less the entire territory of Honduras. In other words, the disasters were associated with Mitch, but were related to a particular range of localised hazards and vulnerabilities, configured in the context of broader development processes at the global and national level.

Apart from the large-scale and medium-scale disasters that are represented in the DRI, the underlying local conditions of risk, hazard and vulnerability are manifested as frequently recurring small- and medium-scale disasters that are either individually too small to be included in global datasets, or else are not reported internationally.

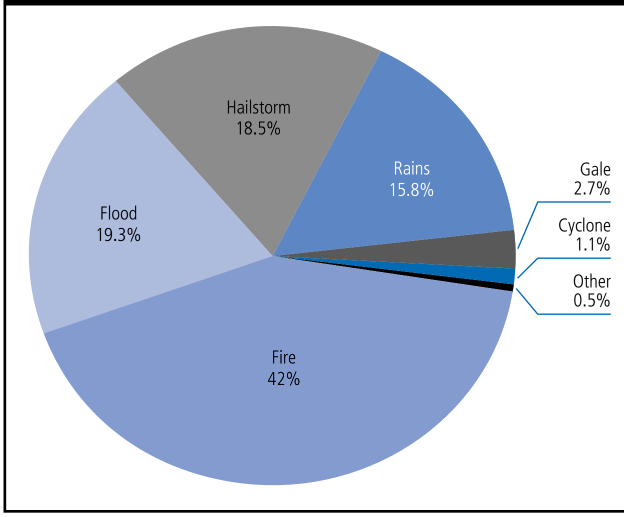
Such events represent a significant proportion of disaster loss in countries such as Panama, which is only rarely affected by major hurricanes and earthquakes. In Panama, the official national disaster database maintained by the National System for Civil Protection recorded 904 disaster events between 1996 and 2001.[6] These 904 events are associated with only 46 deaths, but involved considerable damage to livelihoods.

FIGURE 2.18 NUMBER OF DEATHS REPORTED DUE TO DIFFERENT DISASTER EVENTS IN ORISSA, 1970–2002



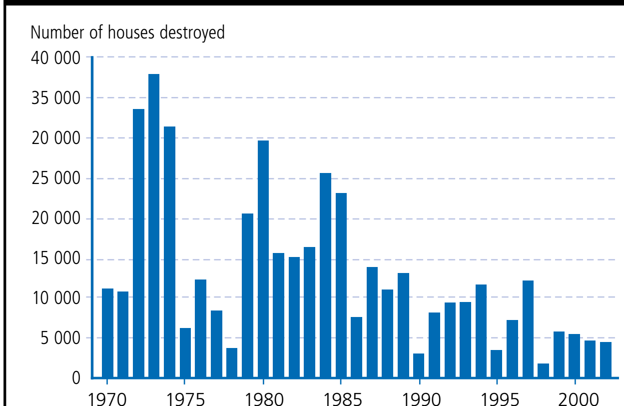
Source: UNDP India, preliminary results of Orissa DesInventar database

FIGURE 2.19 NUMBER OF HOUSES DESTROYED DUE TO DIFFERENT DISASTER EVENTS IN ORISSA, 1970–2002



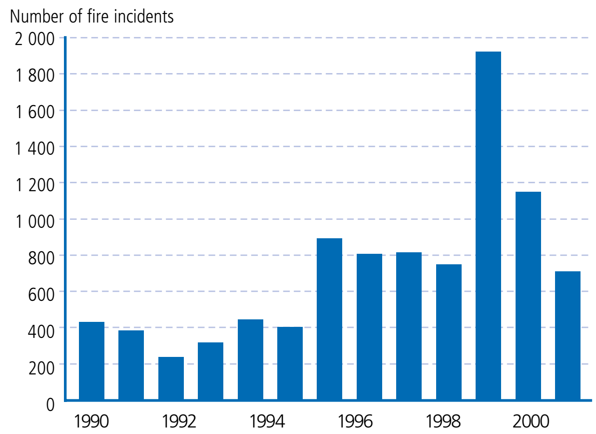
Source: UNDP India, preliminary results of Orissa DesInventar database

FIGURE 2.20 NUMBER OF HOUSES DESTROYED BY FIRE IN ORISSA, 1970–2002



Source: UNDP India, preliminary results of Orissa DesInventar database

FIGURE 2.21 NUMBER OF FIRE INCIDENTS FOR CAPE TOWN MUNICIPALITY, 1990 – 2002



Source: MANDISA Project

For example, 40,531 hectares of crops were lost in these disasters. In the case of small landowners and subsistence farmers without insurance, the loss of a few hectares of crops can represent a catastrophic blow to livelihood sustainability.

Opening the DRI analysis to data feeding in from sub-national databases would introduce a broader spectrum of hazard types. As was mentioned in the section on the DRI, the losses associated with *primary* hazards, such as earthquakes, cyclones and floods, seen at the local level are linked to other secondary hazards events, including fires, landslides and liquefaction.

An examination of disaster losses in the Orissa DesInventar shows that more houses have been destroyed by fire and more deaths are lost in epidemics than through cyclones.

Locally specific data can show the interaction of risk from an array of natural and anthropogenic hazards

Locally specific data can help refine disaster risk reduction policy. The links between disease epidemics and disaster events, particularly floods and tropical cyclones, has long been a focus for research. The dynamics between disaster and disease continue to require a strengthening of our understanding. The importance of fires at the local level and in urban areas points to the need for further work on the relative importance of multiple hazards interacting with development at different levels. Deaths and injuries to road traffic accidents are likely to have a similarly significant local impact.[7]

House fires were not considered in the global DRI, which is oriented towards natural hazards. But this form of anthropogenic hazard is clearly important at the local level. This points to the opportunity for understanding risk processes that could come from exploring the links between development processes and risk to local anthropogenic hazards and larger scale natural hazards. How does exposure to small local events affect individual and collective vulnerability to large-scale hazards and vice versa? What are the implications for local development planning and risk reduction?

Providing a local lens allows for the large number of small events to be catalogued, re-shaping perceptions on risk as a priority concern for development policy. In the MANDISA project, it was originally anticipated, based on expert opinion, that the database would identify about 600 events for the period 1990-1999 in Cape Town, South Africa. In the end, 12,300 events were logged. Preliminary analyses from 1990-1999 have indicated that of the 12,300 incidents, 97 percent were fire-related. The most vulnerable houses were those in the informal housing sector. In an analysis of fire in the poor suburb of Gugulethu from 1990-1999, fires in the informal housing sector constituted 88.5 percent, with only 11.5 percent in the formal housing sector.

2.4 Future Directions in Natural Disaster Risk Modelling

In this section of the Report, two exercises are presented that were undertaken within the DRI. Each pushes against the barriers imposed by data availability. The exploratory nature of these exercises limits the conclusions that can be drawn. But the processes involved are themselves illuminating, they point towards future directions in natural disaster risk modelling.

2.4.1 Can drought risk be modelled?

Compared to the development of the DRI for earthquake, tropical cyclone and flood, modelling drought risk presented a series of additional challenges, which were only partly overcome. These include:

The difficulties in modelling drought hazard *per se.* A model of meteorological drought was used, but meteorological drought does not necessarily lead to agricultural or hydrological drought.