Global Risk And Vulnerability Index Trends per Year (GRAVITY)

Phase II: Development, analysis and results

From
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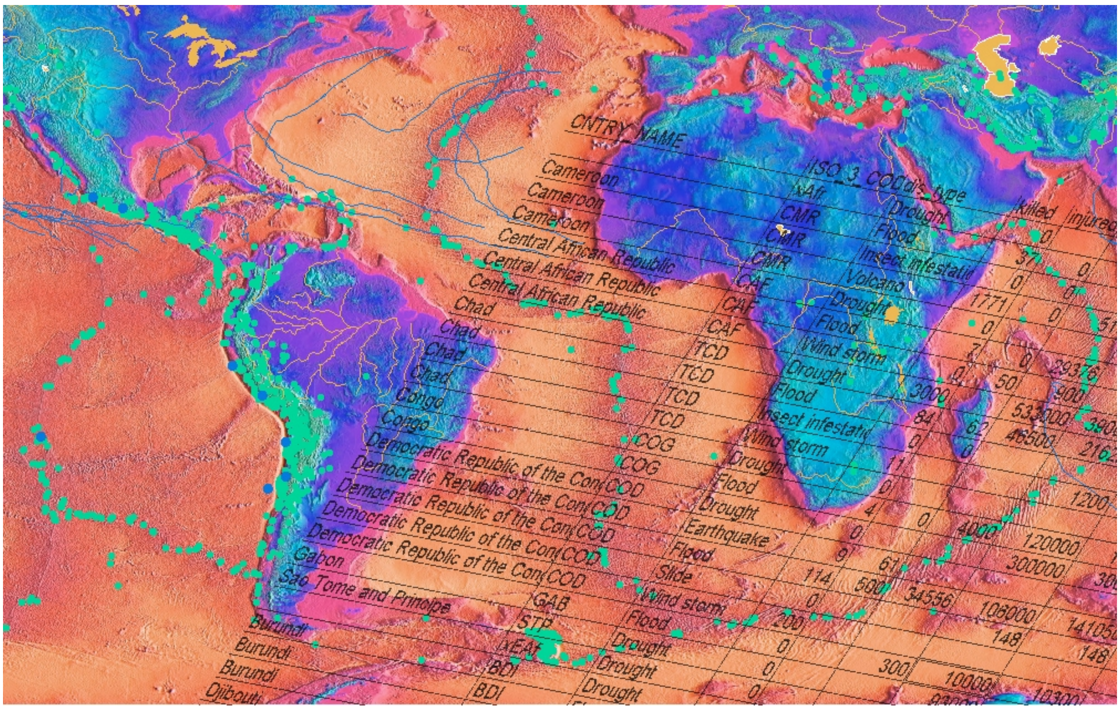
(UNEP/DEWA/GRID-Geneva)

For
United Nations Development Programme
Bureau of Crisis Prevention & Recovery
UNDP/BCPR (formerly ERD)

February 2002



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Acknowledgements

We would like to thanks the following persons whose work has directly or indirectly contributed to the success of this research: Greg Holland and Bruce Harper for their useful advices on cyclone modelling. Haris Sanahuja and Maxx Dilley for helping us to achieve a unification of definitions for the concepts used. Nanette Lomarda from WMO for the contacts and documentation on cyclones. The Fiji Meteorological Service and the Japan Meteorological Agency for their quick response in providing the data for cyclones tracks. Debarati Guha-Sapir, Regina Below and Caroline Michelier from CRED for providing us the access to their most updated version of their database. The GEO3 team from UNEP/GRID-Geneva for prioritising their tasks according to our need in socio-economical data sets.

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AVHRR	Advanced Very High Resolution Radiometer
BCPR	Bureau for Crisis Prevention and Recovery
CDIAC	Carbon Dioxide Information Analysis Centre
CNSS	Council of the National Seismic System
CRED	Centre for Research on Epidemiology of Disasters
ERS SAR	European Remote-Sensing Satellite - Synthetic Aperture Radar
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GIS	Geographical Information System
GRAVITY	Global Risk And Vulnerability Index Trend per Year
GSHAP	Global Seismic Hazard Assessment Program
HDI	Human Development Index
IDNDR	International Decade for Natural Disasters Reduction
IFRC	International Federation of the Red Cross
ISDR	International Strategy of Disaster Reduction
NGDC	National Geophysical Data Centre
NOAA	National Oceanic and Atmospheric Administration
OCHA	Office of Coordination of Human Affairs
OLS	Ordinary Least Squares
OFDA	Office of US Foreign Disaster Assistance
PGA	Peak Ground Acceleration
UNDP/BCPR	United Nation Development Programme, Bureau for Crisis Prevention and Recovery
UNEP/GRID	United Nation Environment Programme, Global Resource Information Database
USGS	United States Geological Survey
VEI	Volcanic Explosivity Index
WFP	World Food Programme
WHO/OMS	World Health Organisation
WMO	World Meteorological Organisation

INTRODUCTION

The United Nation Development Programme, Bureau for Crisis Prevention and Recovery (UNDP/BCPR) has initiated an effort for identifying the countries with the highest needs. The World Vulnerability Report (WVR) aims to highlight causes leading to human vulnerability and identifying population at risk. In order to identify these populations, the localisation of the areas at risk as well as a comprehensive understanding of the different causes turning hazardous events into disasters constitutes a compulsory step. This includes the collection of information and data sets for estimating this risk and the identification of the actions needed to decrease the future casualties.

A risk exists when there is an intersection between population and a potential occurrence of hazards. The first task is to identify where these events are more likely to strike human settlements. Countries are not equally exposed to natural hazards; differences in geophysical factors (slopes, elevation, proximity from the shore or geological fault, inter-tropical location, …) are parameters leading to higher occurrence and severity of natural hazards. The reasons why people are living in these areas are multiple: lack of other choices may account for a certain number, but access to resources (such as fishing for the seashore, fertile soils around volcanoes and flood plains, …) and also ignorance of the risk faced due to low frequency (returning period) of most events are significant parameters among others.

With growing population and infrastructure's complexity the humanity is facing higher risk of casualties. So far the international community has mostly reacted after the events. However, using appropriate measures of risk reduction, casualties may have been drastically reduced. Although there are no means of stopping earthquakes or cyclones from happening, reducing the risk can be done in several ways: one can contain floods by building dams or stabilise slopes for decreasing the number of landslides (prevention measures). One can help the populations living in hazard prone areas to adopt appropriate settlement planning, building codes, access to information and early warning systems as well as acquiring appropriate means of intervention. Prevention, mitigation and preparedness capabilities can be enforced. All of these are means of risk reduction, either by decreasing hazards through prevention or decreasing vulnerability by reinforcing population resilience.

The difficulties when trying to compare human vulnerability consist on differentiating whether populations are affected because of a high frequency and/or magnitude of events, or because of a high vulnerability as different situations require different types of action. This supposes the access to extensive geographical data sets in order to estimate the physical exposure (frequency, magnitude and population exposed), as well as precise socio-economical factors, which can be correlated with the percentage of victims estimated. The main limitation while mixing geophysical and socio-economical parameters lies in the difference of time scale. Earthquakes or volcanoes may have a returning period measured in several centuries, whereas socio-economical features can change extensively during a simple decade! Other difficulties are inherent to global scale, how to compare the situation of earthquakes in South America with the problem of drought in Africa? Not only the number of people affected is very different, but also the percentage of occurrence varies largely for each continent. Hazards impacts differs in: scale, (local; regional or global), in coverage (punctual; large area), in danger (frequency or magnitude), in duration (short tem or long terms). Extensive normalisation is needed for comparing countries.

Achievements

This study presents the results from the second phase of the project Global Risk And Vulnerability Index Trend per Year (GRAVITY) developed by UNEP/GRID-Geneva for the UNDP/BPRD. At the end of the first phase - *the feasibility study* - which consisted on the identification of global data sets and indicators for explaining casualties from natural hazards, twelve recommendations were made. They mostly consisted on the creation of geographical links (georeferencing) of the impacts from past events as recorded in the database from the Centre for Research on Epidemiology of Disasters (CRED). By deriving the extent, magnitude of the event, the exposed population could be extracted and a percentage of victims computed.

The second phase has concentrated on the delimitation of this physical exposure based on methodologies and collection of data sets previously developed at UNEP/GRID-Geneva [PREVIEW project, 2000], in order to highlight places of high natural hazard occurrences. The number of population living in exposed area was extracted using Geographical Information Systems (GIS). Socio-economical data were downloaded from various sources, thirty six indicators for the period 1980-2000 were introduced into a database. The research focus on four hazards namely earthquakes, volcanoes, cyclones and floods.

The main results achieved consist on an improved evaluation of the physical exposure as well as the identification of socio-economical variables leading to higher vulnerability. Using GIS for spatial analysis, areas of intersection between hazards occurrence and population were identified. Except for volcanoes, significant relationship between the number of casualties, physical exposure and socio-economical parameters were found. A statistical analysis demonstrated that physical exposure constitutes the major factors leading to casualties, but other socio-economical parameters are contextual variables leading to higher human vulnerability. These results show the role of the development in the resilience capacity. This corroborates what was often intuitively understood, however, this is now confirmed by statistical evidence. If several factors of vulnerability were identified, a model of prediction can not be derived. This is a consequence of the method used, based on average of victims over a twenty years period. The variation in number of victims within the same country is also depending on time and context factors, thus producing a large variation of casualties within the same country. If prediction for a single event cannot be produced, estimation of losses for longer terms (e.g. 10 years) should be relevant. Categories of country facing equivalent risk can be produced. Thus allowing to identify countries with the highest needs.