Impacts of Floods in South Asia

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Abstract

The impact of natural disasters is an increasing problem in South Asia, as illustrated by the recent tsunami and earthquake. Recurring floods of various magnitudes continue remain to adversely affect South Asia. Though floods are important for the replenishment of the soil for agricultural productivity and fisheries for the sustainable liveellihoods of the people, large floods result in loss of lives and property, affecting the development of the region. This paper reviews the global disaster database on floods. It provides an analysis of flood data available on the International Disaster database (EM-DAT) from 1976 to 2005 for South Asia and presents trends in terms of frequency, number of people killed, affected and economic damage. In the period 1976–2005, Asia's share was 41% of global occurrence of flood disasters accounting for 65% of people killed and 96% of those affected. South Asia accounts for 33% of the floods in Asia, 50% of those killed and 38% affected. A review of the database underlines the importance of systematic data collection and management, which still remains a challenge in the region. Standardization of data collection and appropriate methodologies are urgently needed for improved hazard and vulnerability analysis, establishment of early warning systems and for devising appropriate policies on disaster risk reduction.

Introduction

In the last decade of the 20th century, floods killed 100,000 persons and affected over 1.4 billion people around the world (Jonkman 2005). It is estimated that the annual cost to the world economy due to flooding is about 50–60 billion US dollars. According to a study by the United Nations (UN), floods claimed an average of 22,800 lives annually and caused an estimated damage of US$ 136 billion to the Asian economy (UNESCO 2003). The losses incurred by developing countries are five times higher per unit of gross domestic product than those of rich countries (UNESCO 2006).

South Asia covers about 3.2% of the world land area and 10% of Asia, with over a population of over 1.46 billion accounting for 25% of the world population (CIA 2005). South Asia comprises eight countries, viz. Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka and houses about 40% of the world's poor.

The major rivers of South Asia are the Indus, Ganges, Brahmaputra and the Meghna. The Kabul river originates in Pakistan and flows through Afghanistan. It is one of the major tributaries of the Indus. The Indus and its tributaries flow south and west to empty into the Arabian Sea. The Ganges and the Brahmaputra and their tributaries flow south and east to enter the Bay of Bengal. These rivers provide sustenance to more than 500 million people of the region, supplying water for drinking, irrigation, hydropower generation, fisheries, and inland navigation, as well as for the maintenance of wetlands and biodiversity. But these rivers are also the source of different types of floods that adversely affect the socioeconomic development of the region.

The climate of South Asia is dominated by the South-West monsoon, with significant spatial and temporal variations in rainfall and temperature throughout the region. The heaviest average annual precipitation of 11,873 mm has been recorded at Mawsynram, a small town near Shillong, in the Meghalaya Hills in India (Bandyopadhyay 2006). From the east to the west of the region, the rainfall decreases, with some areas having with less than 400 mm of rainfall annually. Given the varying topography, geographical location and meteorological conditions from North to South and East to West, floods of varying types occur including flash floods, debris flow, landslides, and glacial lake outburst floods, etc.

Most of the countries in this region have a large rural population dependent on agriculture and with high population density. About 28% of the total population is urban. The economic growth is relatively low compared to that of other regions of the world. The per capita income varies from a minimum of US$ 250 in Afghanistan to US$ 2,390 in the Maldives. Compared to the development indicators of other regions, South Asia occupies a grim picture. Besides the existing physical and environmental factors in South Asia, these poor social and economic conditions further increase the vulnerability to different types of disasters like floods, landslides, earthquakes, and others. The key development indicators of South Asia that contribute to increased vulnerability are provided in Table 6.1.

Disaster data are vital for identifying trends in the impacts of disaster and tracking relationships between development and disaster risk (IFRCRCS 2005). For any flood event, loss of lives, total number of people affected as well as the economic damage can be considered as indicators for assessing flood impacts. There have been some studies in the

past that looked into global and country-specific perspectives of floods. Jonkman (2005) has investigated the loss of life statistics for different types of floods and regions concerning a large number of flood events worldwide with information from the OFDA/CRED Emergency Disaster Database (EM-DAT) from 1975 to 2002. A study by Dutta and Heradth (2004) has analysed trends of flood disasters in Asia for a thirty-year period from 1973 to 2002 using the EM-DAT database. The study, is however, is limited to analyzing the flood frequency.

This study investigates the statistics on loss of life, total people affected and economic damage due to floods in South Asia based on the statistics available from the EM-DAT. The paper provides a review of the global database on disasters, particularly on floods and presents the analysis of the trends in South Asia during the last thirty years.

Table 6.1: Key indicators of South Asia

Indicators	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Area (km2)	647500	144000	47000	3,287,590	300	147181	803,940	65,610
Population (millions) 2005	21.9	141.8	0.66	1094	0.33	27.1	155.8	19.6
Annual growth rate(%)*	4.4	1.9	2.4	1.4	2.5	2	2.4	0.8
Infant mortality rate (per 1,000 live births) 2004		56	67	62	35	59	80	12
Agricultural land (% of land area) 2000	58.3	69.8	12.2	60.8	33.3	29.3	32.6	36.5
Access to safe water (% of population)2004	39	74	62	86	83	90	91	79
Access to sanitation (% of population)1995	12	35	69	16		23	39	
Adult literacy rate (% of people 15 & above) 2003	51 (M); 21 (F)	54(M); 32(F)	60 (M); 34 (F)	70(M); 48(F)	91(M); 97(F)	63(M); 35(F)	62(M); 35(F)	95(M); 90(F)
Per capita commercial energy use: annual (Kg of oil equivalent) 2003		159		520		336	467	421
Per capita electricity consumption (KWh)2003		128		435		68	408	325
Population below national poverty line (%)	53 in 2003	45 in 2004		25 in 2002		31 in 2004	32.0 in 2000	32
Per capita GNI (US $), 2005	250	470	870	720	2390	270	690	1160

Source: FAO's Information System on Water and Agriculture, World Factbook, 2005, CIA, (http://www.fao.org/ag/agl/aglw/aquastat/water_res), Bhutan census 2005, World Bank Report.
Note: Blank spaces in the table indicate that there is no data available.

Review of Available Disaster Database

A review of the existing disaster-related database available online was conducted. A summary of the reviewed disaster database in this study is presented in Table 6.2. The summary includes the coverage, period of data available, type of natural disaster and the source of information. It also provides the web addresses from where detailed information can be accessed. The reviewed database was limited to the comprehensive databases which collects data systematically and provides statistics on the loss of life, affected and economic damages on natural disasters focusing on floods and includes EM-DAT, NatCat, Sigma, Darthmouth Flood Observatory, Glide and DesInventar.

A wide number of global, regional, sub-regional and national disaster database are found to be available which documents the impacts of natural and technological disasters. The disaster databases available online are quite varied in nature in terms of the details of the parameters reported. There is no single uniform, standardized method that has been followed for data collection of disasters by any of the databases. The data available in these databases are primarily from secondary sources like the aid agencies, insurance companies, newspapers and media reports, etc. Only limited data is available from the government agencies. Each of the databases is found to focus on a particular purpose and hence differs in its definitions, analysis and reporting.

The EM-DAT is a public database initiated in 1988 with a global observation level and a national resolution level. It provides data and statistics on the occurrence and impacts of natural disasters over a period of time. It is the most complete database available. The EM-DAT has arranged and provided information according to country and thematic aggregations. EM-DAT contains data on the occurrence and effects of over 12,800 disasters in the world from 1900 to the present. The database is compiled from various sources, including UN agencies, non-governmental organisations, insurance companies, research institutes and press agencies. The main objective of the database is to assist humanitarian action at both national and international levels. There is a set criteria for entering a disaster into a database, for example, when at least 10 or more people are reported killed, 100 people reported affected, declaration of a state of emergency or call for international assistance (http://www.em-dat.net). Often small-scale disasters at a local level are not included in this database. A study by Guha Sapir et al. (2002) has conducted a comparative analysis of three global datasets: EM-DAT, NatCat and Sigma.

NatCat is maintained by Munich Reinsurance Company and is a private international level database on natural disasters with a focus on economic losses (http://mrnathan.munichre.com/). Partial information of the database is available to the public with natural hazard maps, list of major disasters and country profiles. The major

disasters for different periods from 79 AD are presented in maps and reports are available on individual events that list the number of dead, affected and economic damage. At a country level the degree of exposure to different hazards and percentage of area affected is illustrated by bar charts.

Sigma is a global natural disaster database including man-made disasters and is maintained by the Swiss Reinsurance Company. Events are recorded from 1970 to the present. Sigma presents annual information on insured property losses, plus economic and human losses. A lesser amount of entries of disaster event is available on this database since information on countries with low insurance density is limited. The worst disasters in terms of victims and insurance losses for different years are presented in charts and tables and are available on the website. In-depth research on worldwide insurance markets are published in Sigma series, which includes risk perception, technical publishing and focus reports.

DesInventar is a database intended for use in the local and national management of risks. DesInventar was developed in 1995 to capture datasets at a local as well as national level of all different disasters including small and medium-scale disasters. This database registers disaster data which are not available or reported in global and large-scale natural disaster databases. DesInventar gives details of every type of effect disasters have. DesInventar is useful for governmental organizations for prevention and mitigation of disasters and for planning and decision making. It is also useful for researchers, humanitarian and non-governmental organizations, health institutions, etc., from local to international scales. The DesInventar was first developed for the Latin American countries and now has been introduced in Nepal and India through UNDP to apply the methodology and use the software. The International Strategy for Disaster Reduction (ISDR) has conducted a comparative analysis of EM-DAT and DesInventar in 2002, aiming towards improving the quality, coverage and accuracy of disaster data (ISDR 2002).

The Dartmouth Flood Observatory provides an archive of extreme flood events, which is geo-referenced to the nearest degree from 1985 to present (http://www.dartmouth.edu/~floods). It seeks to promote research and better understanding of extreme events and its causes and improve access to satellite-based measurements and mapping. The information is available in the public domain. The observatory detects, maps, and measures major flood events worldwide using satellite remote sensing. The database is expected to be useful to predict where and when major flooding will occur and to analyze trends over time. The long-term history of flooding observed from space is compiled as a World Atlas of Flood Hazard. Rapid response inundation maps of large

floods are also available. Information and data on loss of lives, affected people and economic losses have not been found to be reported in this database.

The Asian Disaster Reduction Centre (ADRC) documents disaster information of countries from Asia and South East Asia primarily for its members (http://www.adrc.or.jp). It provides information about all types of natural disasters since 1998. All the information is provided in chronological order. Each event that is reported is provided a unique global identifier (GLIDE) number, location, date, number of dead, evacuated and material damage. The GLIDE number is given to each individual disaster event for all databases and hence maintains the uniformity in reporting of disasters. This database provides a country-wise searchable disaster data. Information is provided from various sources and includes UN agencies (OCHA), Reuters and international news agencies, Relief Web and NGOs. ADRC has also analyzed and published disaster data from 2000, the latest being the data book for 2004.

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Analysis of Flood Data for South Asia

Methodology of Temporal and Spatial Reporting of Flood Events

The EM-DAT database provides disaster datasets according to location, timeframe and disaster type. On a spatial scale, datasets are reported for 17 regions as well as country wisefor individual countries. The datasets are available over 10-year period intervals as well as for each individual year. In the EM-DAT, disasters are broadly categorized into two main types: namely, natural and technological. Natural disasters include hydro meteorological, geological and biological disasters. Hydro-meteorological disasters includes floods and wave surges, storms, droughts and related disasters (extreme temperatures and forest/scrub fires), and landslides and avalanches. The EM-DAT database defines flood as a 'significant rise of water level in a stream, lake, reservoir or coastal region'. Floods due to cyclones are included under different hazard categories (windstorm and wave/surge). Geophysical disasters include earthquakes, and volcanic eruptions. Biological disasters cover epidemics and insect infestations. Country profiles provide a summary and profile of disasters for a particular country. A disaster list is also available in the EM-DAT database, which allows one to generate a list of events for a particular spatial scope, period of

time and disaster type. Given the comprehensivenss of the EM-DAT database, this has been selected for the current study for further anlaysis of the impacts of flood in South Asia.

In the database, nine countries are included under South Asia as per the UN`s sub region. In the current study, the countries that are members of the South Asia Association for Regional Cooperation are: Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka have been included excluding Iran Islam Republic have been included. The Asian Development Bank (ADB) also uses the same grouping. The current analysis uses data period for three decades from 1976 to 2005.

Table 6.2: Review of Global Flood Databases

Database	Coverage	Period	Type of Natural Disasters	Source of Information
EM-DAT (OFDA/CRED) Emergency Disaster Database (www.em-dat.net)	Global, regional and country wise (about 12,000 entries)	1990-present	All types of Natural Disasters and man made disasters including conflict	UN agencies, Govt agencies, IFRC, research centres, insurance agencies, press, media and private
Dartmouth Flood Observatory (www.dartmouth.edu/floods)	Global coverage	1985-present	Large Floods	Wide variety of news agencies, governmental, instrumental, and remote
NatCat (Munich Reinsurance Company) (http://mrnathan.munichre.com)	Global (about 20,000 entries with about average 800 entries per year)	79 AD-present (only major events recorded prior to 1980)	Natural Disasters including volcanic eruption, floods, storms, earthquake and others	Insurance related media and publications, online databases and information systems from news agencies, govt and non-govt organizations, media reports worldwide network of scientific and insurance contacts, technical literature, Munich Re clients and branch offices
Sigma (Swiss Reinsurance Company) (http://www.swissre.com)	Global (about 7000 entries)	1970-present	Natural and man made disasters excluding drought	Daily newspapers, Llyod's list, primary insurance and reinsurance periodicals, internal reports, online databases
DesInventar	16 countries of Latin America and Caribbean,	Varying	Natural Disasters	Newspapers, official data from various governments,
Asian Disaster Reduction Centre (http://www.adrc.or.jp)	Global	1998-present	All types of Natural Disasters including floods	UN agencies (OCHA), Reuters and international news agencies and NGOs.

Analysis of Datasets

Individual country statistics of these eight countries of South Asia available in EM-DAT database have been reviewed and analyzed. A total of 332 flood events are recorded in the database over three decades from 1976 to 2005. A list of flood events for South Asia was generated for the period 1976 to 2005. The list provides details of the event, which includes type of flood, location, start and end dates, people killed, and affected as well as economic damage. Out of the 332 reported flood events, 20 events were categorized as flash floods and 3 as valley floods. A close inspection of the location and types of floods reported in the database revealed that there was no consistency and uniformity in the reporting. In the database, many of the floods that are likely to be flash floods have not been reported as such but under a general category of floods, for example, in Chittagong in Bangladesh and Himachal Pradesh in India, where flash floods are common. A similar kind of lack of completeness was observed in many of the recorded events. Therefore, with the available datasets for the period 1976–2005, categorization and analysis for different types of floods could not be conducted. This study is limited to the general flood disasters in the region with no sub types of floods. All the data available on reported events have been used for the analysis.

All of the 332 events that have been reported in the EM-DAT database for the thirty-year period are not separate individual events. In some cases multiple, separate events are aggregated to one record. This inconsistency in data reporting could to some extent affect the interpretation of the data, as was also cautioned by Jonkman (2005) as a spatial aggregation issue.

Distribution of Natural Disasters in South Asia

During the past three decades (1976–2005), the reported number of natural disasters in South Asia is 943, out of which those caused by floods is 332, accounting for 35% of the natural disasters. This is higher than the global value of 30%, showing that in South Asia, floods are a major hazard followed by windstorms, which include cyclones. The distribution of natural disasters in South Asia is presented in Figure 6.1.

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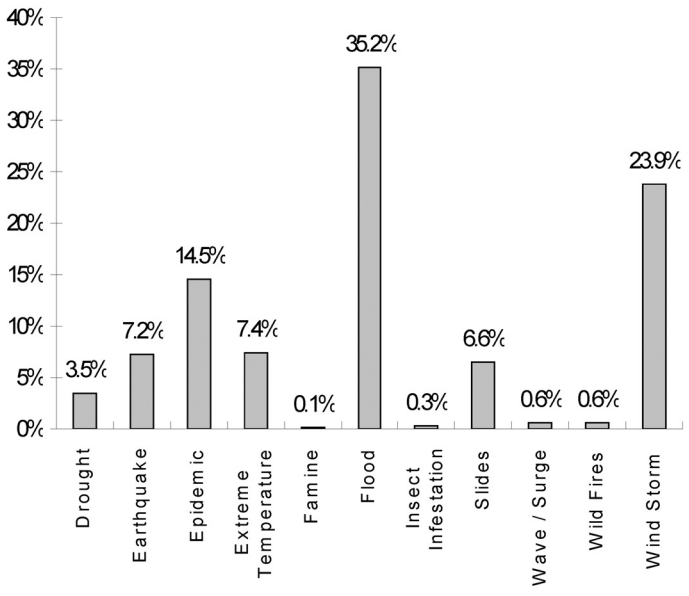
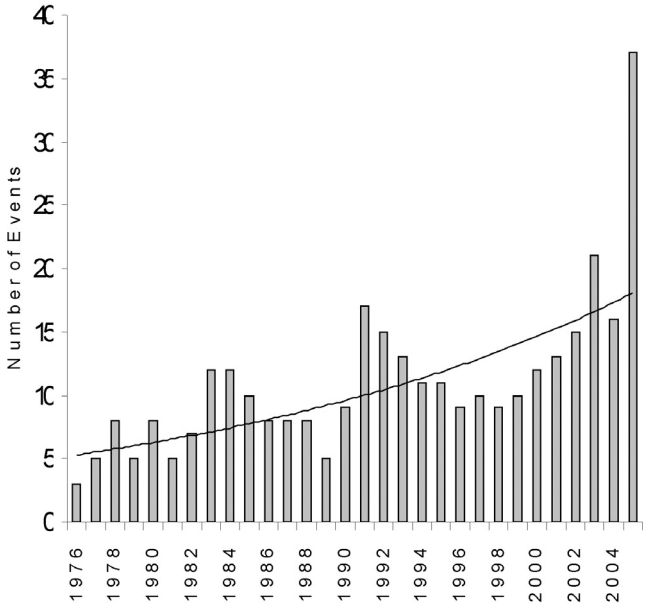


Figure 6.1: Distribution of Natural Disaster in South Asia: 1976–2005

Total Number of Flood Disasters

The reported number of flood disasters has dramatically increased over the last three decades, as shown in Figure 6.2. A similar increasing trend has also been observed for Europe (Hoyois and Guha 2003) as well as globally (Jonkman 2005). To some extent, this increase in flood disasters can be attributed to improved information communication technology (ICT), leading to increase in reporting activities; however, this in itself is not the only the cause. It could also be attributed to the increased socioeconomic vulnerability and development processes leading to increased number of disasters. The impacts of population and economic growth, rapid urbanization, environmental degradation, and climate change are some of the factors that contribute to this increased trend.

Figure 6.2: Total number of flood disasters reported in South Asia: 1976–2005



It must be recalled here that the UN World Conference on Disaster Risk Reduction was also held in January 2005 in Kobe, Japan. It provided recommendations and the Hyogo Framework for Action (HFA) to decision makers and risk managers for disaster risk reduction, including flood disasters. The HFA has highlighted the need for improved compilation of information on disaster risk and impact at all scales for sustainable development. The recent 2005 report entitled 'Natural Disaster Hotspots: Case Sstudies' launched by World Bank claims 2005 to be a record year of natural disaster-related incidents, which killed more than 90,000 people and affected more than 150 million lives worldwide (2005).

Total Number of People Killed by Floods

During the last three decades a total of 491,074 deaths has been reported due to natural disasters in South Asia. Hydro meteorological disasters resulted in 337,917 deaths (~70%), out of which floods account for 64,658 numbers of deaths (~20%). The loss of life due to the 2004 tsunami has skewed the percentage. Over the period 1976–2005, on an average 2,154 people awere killed annually due to floods in South Asia. Though there is a variation in the number of people killed annually, in general there is an increasing

trend, as shown in Figure 6.3. The five flood events that killed the most number of people in South Asia over the thirty-year period are given in Table 6.3. The floods in Northeast India in 1978 and the floods in Bangladesh in 1988 stand out prominently. Here it should be noted that some of the flood reports in the EM-DAT isare a mixture of several individual events lumped into one record. This is the case for the 1994 as well as the 1998 events reported in India, which combines the floods from different parts of the country occurring in the same month under one record.

Figure 6.3: Total number of reported killed due to floods in South Asia: 1976–2005

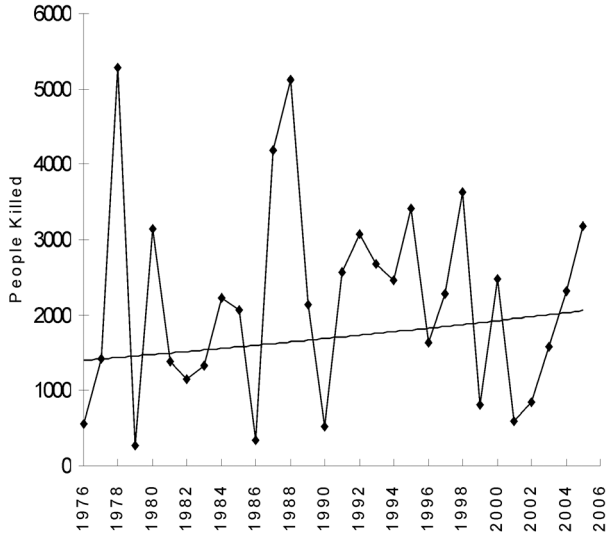


Table 6.3 Flood events in South Asia with most number of people killed: 1976–2005

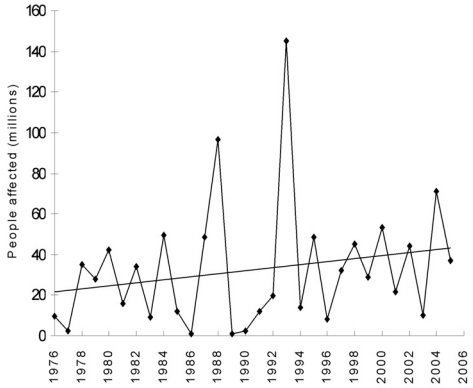
Country	Year	Month	Killed	Total affected	Description
India	1978	7	3800	32,000,000	North, Northeast
Bangladesh	1988	8	2379	73,000,000	
Bangladesh	1987	7	2055	29,700,000	Rangpur, Netrokona, Gaibandha, Noagaon, Kurigram, Jamlpur, Cox's Bazar, Chittagong, Noahkali districts
India	1994	5	2001	12,060,050	Assam, Arunachal Pradesh, Jammu and Kashmir, Himachal, Punjab, Uttar Pradesh, Goa, Kerala, Gujarat states
India	1998	8	1811	29,227,200	Assam, Arunachal, Bihar, Kerala, Meghalaya, Punjab, Sikkim, Uttar Pradesh, West Bengal states

Total Number of People Affected by floods

The total number of estimated people affected by floods in South Asia in the last three decades from 1976 to 2005 is close to 1 billion. The 1988 floods in Bangladesh have been reported to have affected more than half the population totaling to about 73 million people. Similarly, in 1993 floods in different parts of India affected more than 100 million people in the states of Punjab, Haryana, Himachal Pradesh, Gujarat, Jammu and Kashmir, Rajasthan, Madhya Pradesh, Chandigarh and Assam States.

In South Asia there is an increasing trend in the number of people affected by floods. India has the highest number of people affected by floods, followed by Bangladesh. The number of people affected by floods in South Asia from 1976 to 2005 is shown in Figure 6.4.

Figure 6.4: Total Number of people affected by Floods in South Asia: 1976–2005

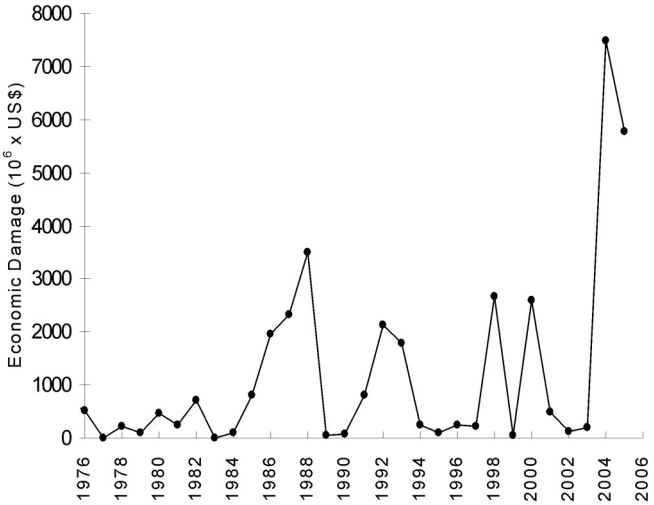


Economic Losses due to Floods

The total economic loss reported for the 30-year period from 1976 to 2005 is about 32 billion dollars. Figure 6.5 shows the reported economic losses due to floods. In 1988, Bangladesh experienced one of the worst floods in living memory, which resulted in a total cost of approximately US $2 billion to the national economy of approximately US $2 billion killing 2440 around 2,400 people. In 2004, Bangladesh is reported to have experienced a huge economic loss due to floods to the tune of US $7 billion. This huge economic loss compared to previous years can be attributed to increased population density, higher per square kilometre GDP and infrastructural development in floodplains and urban centres. This steep rise in economic loss for 2004-5 may also be attributed to the incompleteness in the data recorded in previous years as compared to 2004.

World Disasters Report 2005, published by the International Federation of Red Cross and Red Crescent societies also reports that data are most incomplete for economic losses for natural disasters (IFRCRS 2005). It further states that due to lack of standardized methodology, loss estimates from Iran's Bam earthquake in 2003 ranged from US$ 32.7 million to US$ 1 billion. Livelihood losses, especially in the informal sector, are also poorly understood and rarely recorded. The reports available on the EM-DAT database on economic losses due to floods in South Asia are limited. Some of the countries have no reports on economic losses, for example, Bhutan while those available appear to be incomplete. Due to the incompleteness in the recorded data as well as lack of standardized methodology, caution should be exercised in using the data for any kind of interpretation.

Figure 6.5: Economic Losses due to Floods in South Asia: 1976–2005

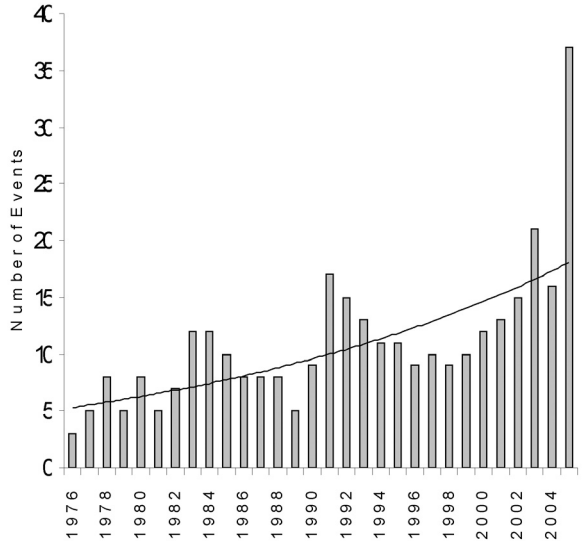


Trend Analysis

In the last thirty years annual flood frequency has doubled. From 1976 to 1985 there were 75 flood events, which increased to 105 in the next decade and then to 152 from 1996 to 2005. These results for South Asia with respect to the flood frequency agree with the result obtained by Dutta and Heradth (2004) in Asia for the period 1973–2002. The increasing number of frequency of flood disasters can be attributed to improved communication technologies resulting in better reporting as well as climate change,

land use change and surface degradation. Table 6.4 provides the reported number of flood events over the last three decades.

Table 6.4: Number of flood records in South Asia (1976–2005)



The trend in flood impacts in terms of people killed and affected has been analyzed for each decade as well as for the thirty-year period. Analysis on a decade-wise basis shows that there is an increasing trend in number of people killed and affected by floods from first decade, 1976–1985 to the second, 1986–1995. In the third decade, from 1996 to 2005 there is a slight decrease in the number of killed as well as the number of those affected. The increasing trend from the first decade to the second is in agreement with those reported in the second World Water Development Report but not for the second to the third decade. With limited data available, it is difficult to pinpoint the cause of this decrease. However, it should be noted here that three of the five extreme events reported in South Asia over the thirty-year period are from 1986 to 1995, as was presented in Table 6.3 earlier. The extreme events in that decade could possibly affect the trend.

For the entire thirty-year period however, there seems to be an increasing trend in the number of people killed and affected. The increase is more significant in the number of people affected in comparison to the number of people killed, as can be observed in Figure 6.6. These results agree with the findings of the impacts of global flood disasters reported by Jonkman (2005).

Flood Impact Analysis by Country

In this section the impact of flood disasters during the period 1976–2005 by country is provided. Table 6.5 shows that India has a larger percentage of impact compared to other countries in South Asia. During the thirty-year period, about 40% of the events were reported from India, followed by Bangladesh (17.2%), Pakistan (12.3%), Afghanistan (12.0%), Sri Lanka (10.2%), Nepal (7.2%), Bhutan (0.9%) and the Maldives (0.3%). About 58% of those killed are reported from India, followed by Bangladesh (16.4%). Similarly, about 68% of those reported affected are from India, followed by Bangladesh (26.4%). The bulk of the economic damage is also reported to have been contributed by India and Bangladesh, with nominal damages reported by other countries. The large size and the population of India contribute to larger flood impacts. A study conducted by Dhar and Nandargi (2003) has shown that the flood problem in India is mostly confined to the states in the Indo-Gangetic plain, northeast India and occasionally in the rivers of Central India. The area vulnerable to floods in India is 40 million hectares (12% of the total land area) and the average area affected by floods annually is estimated to be about 8 million hectares, leading to 1,793 deaths annually (HYPERLINK "http://www.nidm.net/flood.asp" http://www.nidm.net/flood.asp). While in Bangladesh about 80% of the total land is vulnerable to floods exposing a larger population to flood hazard.

Figure 6.6: Trend Analysis of number of people killed and affected in South Asia:1976–2005

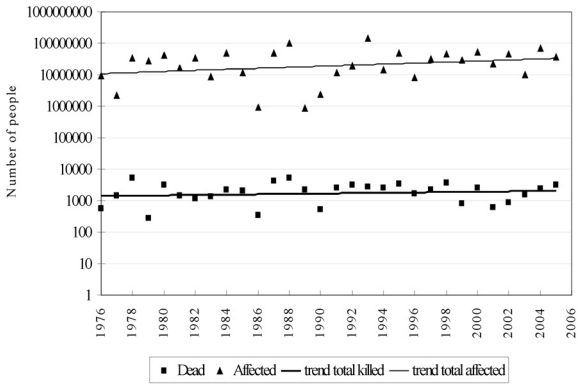


Table 6.5.: Country-wise flood impact analysis for South Asia

Country	Number of flood events	Total killed	Total affected	Economic damage US $
Afghanistan	40 [12.0%]	3160 [4.9%]	758,560 [0.1%]	376,000 [1.2%
Bangladesh	57 [17.2%]	10,636 [16.4%]	257,581,101 [26.4%]	13,373,500 [41.5%
Bhutan	3 [0.9%]	222 [0.3%]	1600 [0.0%]	
India	132 [39.8%]	37,504 [58.0%]	665,801,325 [68.2%]	15,312,592 [47.5%
Maldives	1 [0.3%]	0	300 [0.0%]	6,000 [0.0%
Nepal	24 [7.2%]	4792 [7.4%]	2,387,994 0.2%]	990,313 [3.1%
Pakistan	41 [12.3%]	7505 [11.6%]	42,573,967 [4.4%]	1,843,230 [5.7%
SriLanka	34 [10.2%]	839 [1.3%]	780,3381 [0.8%]	353,944 [1.1%

Note: numbers is parenthesis [ ] denote percentage

The United Nations Development Programme Bureau for Crisis Prevention and Recovery (UNDP-BCPR) has developed the Disaster Risk Index (DRI) to assess natural hazards such as floods, cyclones, droughts, earthquakes. This index allows global ranking on the basis of relative vulnerability of countries. This is a mortality-based index and the physical exposure of population to the hazard. The physical exposure has been derived on the basis of population distribution and the frequency of hazards for that particular area and represents the average number of people affected yearly by the hazard (UNDP, 2004). According to the report prepared by UNDP–BCPR, most of the countries of South Asia are high in general with Bhutan ranking the most vulnerable to flood disasters, followed by Nepal, Afghanistan and Pakistan. Though the number of people dead and affected by floods in India and Bangladesh is greater as per this DRI, they rank 5 and 6 respectively in South Asia. The indicator over a period of time can help regions and countries to monitor and assess the effectiveness of risk reduction measures.

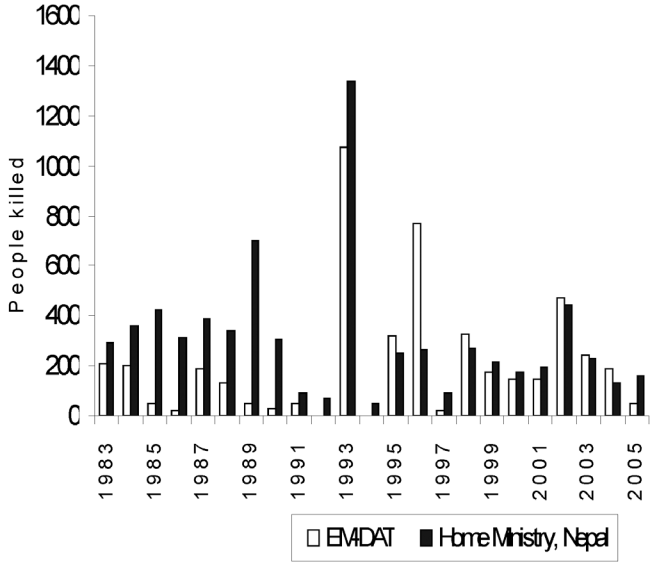
Flood Impact Analysis: Comparison of EM-DAT and National Dataset

This section tries to explore the difference in reporting in the EM-DAT database compared to the data obtained from national agencies responsible for the disaster data in a country. The data from EM-DAT and those obtained form from the Home Ministry of Nepal, which is the focal Ministry for collecting and compiling all disaster-related

data, is compared. Since systematic data collection on the impacts of various types of disasters started in Nepal from 1983, the period of comparison is from 1983 to 2005.

Figure 6.7 shows the comparison of the loss of lives due to floods from the two datasets. The figure verifies the fact that there is less number of events reported in the EM-DAT, indicating that probably the small-scale disasters at a local level are not reported in the global dataset though it is observed that there is better agreement after 2000. From the current data we find that about 30% of the number of people killed is under- reported in the EM-DAT database.

Figure 6.7: Comparison of EM-DAT data with National Agency Data: Nepal



Comparison of Flood Statistics with Other Regions

In this section the flood statistics of South Asia is compared to the statistics of Asia and the other continents. The global distribution of flood disasters of 30 years shows Asia's extreme vulnerability to flood disasters. Globally, over a period of 30 years from 1976 to 2005, over 2 billion people have been affected by floods, killing close to 200,000 people with more than US$ 300 billion reported economic damage. Table 6.6 provides an overview of the number of flood records, total people killed and affected by regions. About 41% of these flood disasters occurred in Asia, 18% in Africa, 25% in the Americas, 12% in Europe and the rest in Oceania.

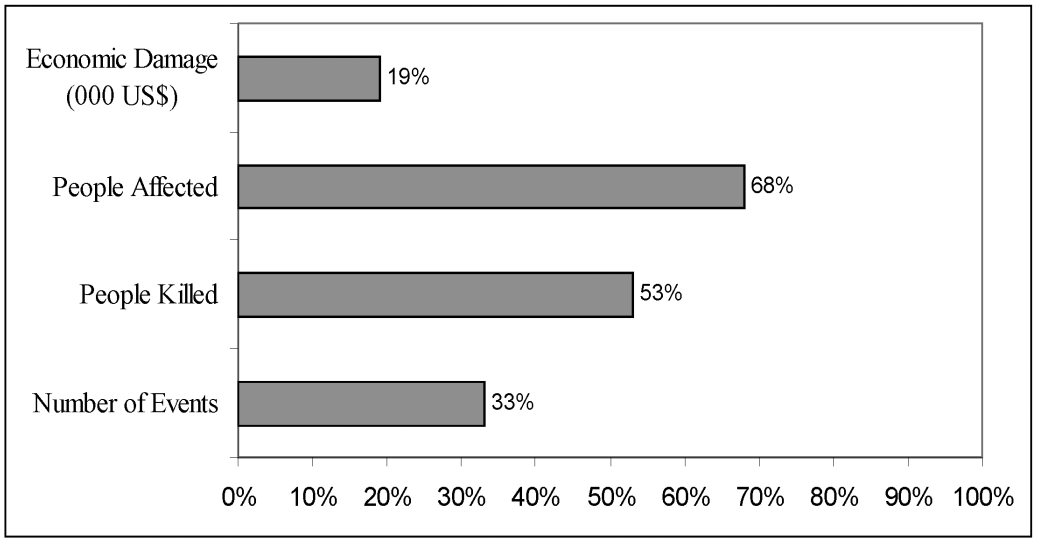
Though Asia'`s share is 41% of the global floods disasters, it accounts for 65% of the people killed and more than 96% of those affected globally, as shown in Table 6.6. South Asia accounts for 33% of the floods occurring in Asia, 53% of those killed and 38% affected, as shown in Figure 6.8.

In comparison, when you look at the economic loss, Asia accounts for about 60% of the global economic damage out of which only about 16% is reported to have been contributed by South Asia. This low figure of economic damage in South Asia could be due to a number of reasons. First, poor and incomplete reporting. Second, there are limited economic damage assessments in the countries of South Asia and a lack of standardized methodology for reporting. Further, it could be a reflection of the state of development of the countries and its relationship with disaster risk since primarily the countries in South Asia are categorized as Least Developed countries with limited resources and economic development. Strong linkages have been identified between poverty, high social vulnerability to and low capacity to cope with water-related hazards and disasters (UNESCO 2006).

Table 6.6: Number of flood events, people killed, total affected, and economic damage by floods in South Asia compared to other regions: 1976–2005

Region	Number of Events	People Killed	People Affected	Economic Damage (000 US$)
Africa	438 [18.1%]	13825 [7.4%]	35,251,124 [1.3%]	3,286,204 [1.0%]
Americas	605 [25.1%]	48506 [25.9%]	43,131,426 [1.6%]	54,821,027 [16.5%]
Asia	994 [41.2]	122521 [65.5%]	2,560,004,272 [96.7%]	200,190,203 [60.1%]
(South Asia)	332	64658	976,908,228	32,255,579
	(33% of Asia)	53%	68%	16%
Europe	292 [12.1]	1975 [1.1%]	7,596,848 [0.3%]	72,482,012 [21.8%]
Oceania	86 [3.6]	219 [0.1%]	528,052 [0.0%]	2,229,155 [0.7%]
World	2415	187046	26,465,411,358	333,008,601

Figure 6.8: Impact of flood disasters in South Asia in comparison to Asia: 1976–2005



Conclusion

EM-DAT's efforts in archiving disaster data are appreciable. The database provides a general overview of the impacts of disasters globally. However, before making concrete conclusions, one has to keep in mind the limitations of this database as media reports may vary with source. There is no clear distinction between riverine and flash floods and an absence of a global standard for reporting floods, for example, some events is a mix of individual flood event as well as for a period of time over a month or a season. This has made the analysis on an event basis difficult. Some floods are not reported typically for South Asia and economic loss/property loss is not often reported or not valued. It should not be interpreted as zero property losses, but as a lack of mechanism to evaluate and report the loss of property. South Asia is one of the poorest regions in the world. People lack the education, resources or opportunities to insure their property (insured value may be used as a good method for determining property losses) against flood disasters.

Nevertheless, this paper has used the database to analyse and compare general vulnerability of South Asia, which is, quite clearly highly vulnerable to flood disasters. In the period 1976–2005, 332 flood events killed about 7065,000 and affected a billion people in South Asia. Statistically, these account for 14% of all reported disasters globally but 35% of lives lost and people affected. These figures indicate that floods have greater

impacts in South Asia and therefore a higher relative vulnerability. The economic and social fabric is disrupted because of floods and has effects on culture and livelihoods. So, what makes South Asia more vulnerable? Is it due to greater magnitude of floods or increased population pressure or poverty and hence limited resources to adapt/respond to disasters. Perhaps, the effect is a combination of all factors to some extent, which cannot be proved with this data that has been analysed.

Recommendations

On Impacts

The impacts of flood disasters cannot be negated easily. Vulnerable communities live with risk albeit with full knowledge of impending disasters. The impetus should be on providing early warning for the vulnerable communities to evacuate their homes on time. Disasters should not be treated in isolation. They must be integrated with other hazard management. A total disaster risk management (TDRM) approach should be adopted.

On data sharing

A basin approach should be adopted in order to understand and provide additional lead time to vulnerable communities. Many organizations such as ICIMOD are already working to achieve this challenging task. ICIMOD is working on regional cooperation for sharing flood information and works towards increasing the national capabilities to predict floods and save lives and properties.

On database

Developing and maintaining a global disaster database is an enormous task. There is a need for a standardized and systematic data collection, including formats and methodology. Standard guidelines for collection of disaster data at various levels could avoid ad hoc reporting. Some efforts are already being made to standardize the process of identifying and reporting disasters such as GLIDE. The GLIDE should be adopted universally. It will eliminate some discrepancies, if not all.

On reporting

Because the main source of data on EM-DAT database is media, the role of media should be highlighted. Ideally, disaster news should always come from the same source from a given country. The leading government agency could be requested to verify data

collected by various media. Disasters and their types and events should be reported separately with a separate index number.

To conclude, in all the countries there is a need to design and streamline the disaster risk reduction policies and measures with long-term social and economic development planning. Flood disasters should not be treated in isolation but be integrated with other hazard management. Capacity building and institutional strengthening as well as education and awareness on disaster preparedness should be promoted. As most of the major rivers are transboundary in nature, resulting in adverse impacts due to riverine and flash floods across national boundaries, basinwide integrated flood management is considered most suitable for coping with increased challenges in flood disaster mitigation. Standardization of data collection and appropriate methodologies are urgently needed for improved hazard and vulnerability analysis, establishment of early warning systems and for devising appropriate policies on disaster risk reduction. There is an increasing need for sharing of data and information and strengthened regional cooperation in flood disaster mitigation. The International Centre for Integrated Mountain Development (ICIMOD), together with its regional member countries isare working on regional cooperation for sharing flood information in the Himalayan region and is working towards increasing the national capabilities to predict floods and save lives and properties. Standardization of data collection and appropriate methodologies are urgently needed for improved hazard and vulnerability analysis, establishment of early warning systems and for devising appropriate policies on disaster risk reduction.

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