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Extreme hydro-meteorological Events and urban development

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ABSTARCT

Extreme weather events in particular heavy rains and floods cause huge losses to economic growth of the country. India receives nearly 4000 billion M^3 water from rains and snowfall annually. However, it shows great seasonal and spatial variability and is concentrated in the summer monsoon season.

Even during the summer monsoon season, short (1-2 days) spells of extreme rainfall can exceed even monthly normal rainfall (of the station), and cause natural hazards, which can turn into a disaster. These disasters are increasing affecting adversely major urban areas. The area and persons affected by floods may increase due to reasons such as deforestation, urbanization and population growth (IPCC AR-4). An analysis of recent data (1998-2007) of Disastrous Weather Events (DWE) (IMD) indicated 34 cases of heavy rains, 71 cases of severe floods, 70 cases of moderate floods, 30 cases of cloud bursts, 88 cases of flash floods over the Indian region. We discuss the important features reported in the recent decade- damage, economic losses and lives lost in these disastrous events.

The paper presents some of these aspects and stresses the need for a sustainable way of development for cities, balancing the needs of various stake holders vis-à-vis the environment.

INTRODUCTION

Water is synonymous with life, and rains are the nature's bounty on this planet. However, there are some negative aspects of this natural phenomenon. More than one billion people in developing countries lack access to clean water and 2.4 billion do not have basic sanitation. Furthermore, most of the natural hazards are associated with hydro-meteorological events. Coupled with this, since 1991, nearly 90 percent of deaths from natural disasters occurred in under developed nations (WMO, 2004).

Extreme hydro-meteorological events such as floods, droughts, flash floods, cloud bursts, heavy rains cause huge losses in terms of damage to agriculture, infrastructure and life. It is estimated that during the 10 – year period 1992-2001, globally, some 622000 people died in natural disasters, such as violent storms and floods. As per the fourth assessment report AR-4, the frequency and intensity of these events are likely to increase due to global warming. While the deaths from natural disasters, due to weather events have declined, yet the economic losses have risen from 3.4 billion US $ to 40 billion US $ between 1950 and 1990 (Heather, 2008). Development and impacts of extreme events are closely related. The paper highlights this aspect.

DATA AND ANALISIS:

The following extreme hydro-meteorological events were considered for the study.:

a) Moderate Floods
b) Severe Floods
c) Flash floods
d) Heavy rains
e) Cloud bursts

In general, the data published in I.M.D's publication 'Disastrous Weather Events' (DWE) were used to prepare a data base in the following way

i) Year wise, for all events.
ii) Event wise casualties
iii) Region wise, for each event.

Details are shown in Table I.

The data of one decade (1998-2007) was considered for analysis. The data reveal that northeastern

Table 1. Total Disastrous Weather Events year wise.

Sr. No.	Event → Year ↓	Cloud Burst	Heavy Rains	Flash Flood	Severe Flood	Moderate Flood
1	1998	0	0	16	19	4
2	1999	4	1	4	3	6
3	2000	3	3	9	9	18
4	2001	8	3	4	3	8
5	2002	0	9	2	3	2
6	2003	0	1	1	5	1
7	2004	8	4	10	6	1
8	2005	0	6	14	19	9
9	2006	4	4	24	3	0
10	2007	3	3	4	1	21
	Total	30	34	88	71	70

region of Assam, Meghalaya, Arunachal Pradesh, Uttaranchal and Sub Himalayan West Bengal are more frequently subjected to these extreme hydro-meteorological events. A recent study by Tongdi et al (2008) has shown that the extreme weather events relating to floods are increasing in terms of economic losses and losses of lives. This is partly due to large scale development activity, which has resulted in increasing vulnerability. The results are supported by the study carried out by Dutta (2004).

The floods have also been reported during the years of moderate drought, such as 2002 and 2004. The rainfall during the southwest monsoon season shows large inter-annual variations, as shown in Fig.1(a) (seasonal rainfall 1901-2009). In addition, throughout the year, the rainfall shows a few peaks in daily rainfall and a large number of low rainfall or dry days (Fig.1(b)). Rainfall of New Delhi and Pune for August 2010 are typical examples.

In the year 2007, the seasonal rainfall during June to September was 105% of the long period average (LPA) for the country as a whole. At the same time rainfall was in excess by 26% of its LPA, over north-east India. However, during the same year out of 120 major and medium rivers only 46 rivers were affected by floods as per data from at 89 gauge / discharge sites all over the country (Nandargi and Dhar, 2007).

Severe floods: The decade (1998-2007) had 71 events of severe floods, including notorious floods of 27 July 2005 in Mumbai. The maximum frequency was in the year 1998 when 19 events of severe floods occurred. The deaths were highest in 2000 (2595).

Moderate floods: 70 moderate flood events were reported during the decade. The maximum cases, 21 in total of moderate floods were reported in the year 2007. The highest number of deaths (307) due to moderate floods was in the year 2007.

Cloud Bursts: It is a popular term for a very sudden and very heavy shower, often accompanied by thunder and hail. It is associated with strong upward and downward currents. The maximum frequency was in the year 2004. 329 people died in the decade, due to cloud bursts. Cloud burst are generally reported from Himachal Pradesh, Uttaranchal and other hilly regions.

Flash floods: During the decade, the number of flash floods reported all over India was 88. The number of lives lost in flash floods was 1255. Maximum number of flash floods (664) occurred in the year 2006. Even during 2004, a drought year, flash floods killed 500 people in Assam in the 1st week of October.

Heavy rains: Total number of deaths reported during the decade was 2262, from heavy rains.

DISCUSSIONS AND CONCLUSIONS:

The reported extreme event losses fluctuated significantly, form year to year. De et al (2004) have summarized the extreme weather events of major consequence in India, for the last hundred years. Apart from immediate impact on agriculture, structures, buildings and population, long term impact on economy was noticed from major urban

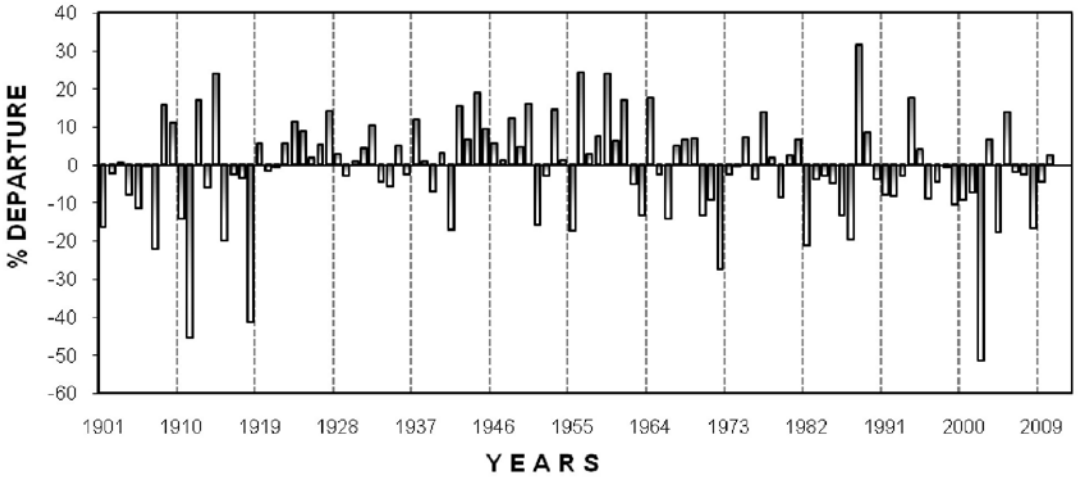

Figure 1. (a) All India rainfall series 1901 to 2009.

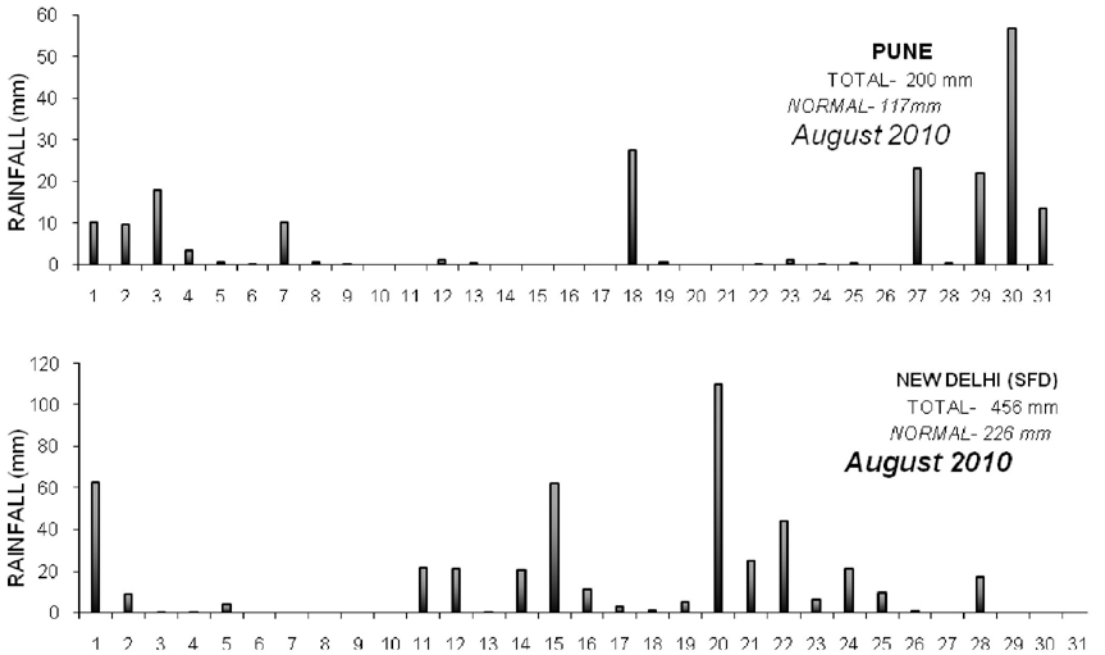

Figure 1. (b) Rainfall in mm New Delhi and Pune for August 2010

floods of Mumbai (2005) and Hyderabad (2000). Immediate impacts due to water and land pollution and poor sanitation and drainage, epidemics and diseases are quite common. These call for urgent and timely disaster management. In this context, we have seen that in the recent years large scale urbanization and developments of roads, infrastructures have led to changing land use pattern.

In the Western Ghats and Uttaranchal deforestation is also responsible for many cases of flash floods and landslides which could be avoided by proper development strategies.

Urban centers are growing up at a faster rate than the services available to the people living in the urban areas. Encroachment on flood plains, poorly constructed houses and lack of preparedness for disaster management add to the losses from extreme hydro meteorological events. Investment in development of civic services can reduce much of the urban vulnerability.

We cannot insulate ourselves from natural hazards but can certainly prevent them, from becoming disasters by sustainable development practices. We highlight the major findings as follows:

1) Extreme hydro-meteorological events cause damage and loss of life every year.

2) Even during drought years losses due to floods occur side by side the drought, though they are located at different places.

3) Flash floods, cloud bursts and intense heavy rains are localized and often unreported in terms of losses with exception when these affect large cities and metros. (Mumbai, 2005, New Delhi, 2010 and Pune, 2010).

4) Poor construction of buildings, occupation of flood plains, poor city drainage network enhance the runoff, leading to damage.

5) Preventing high risk from floods and extreme hydro meteorological events can be achieved by :

i) Rain harvesting in buildings.

ii) Aforestation of open areas, in particular hill slopes.

iii) Preventing construction in the river beds and flood plains.

iv) Preventive maintenance of natural and municipal storm water drainage in dry season before the monsoon.

v) Adaptive measures are needed to meet the impacts of extreme weather events which are likely to be more intense and frequent due to global warming.

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