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CLOUD BURSTS IN HIMACHAL PRADESH

1. Cloud bursts are devastating weather phenomena representing highly concentrated rainfall over a small area lasting for a short time. They lead to flash floods/landslides, house collapses, dislocation of traffic and human casualties on large scale. Though the exact mechanism of these systems is not yet perfectly understood, research bibliography suggests that they are manifestations of intense vortices on small scale (Das, 1988). These vortices generate strong convective currents which lift the moisture laden air with sufficient rapidity to form cumulonimbus clouds which shed their water load with great strength and ferocity. Orographic configuration of an area adds to the vertical lifting necessary for the formation of cumulonimbus clouds.

Himachal Pradesh (HP) is a small hilly state which frequently experiences cloud bursts during the south-west monsoon season (June to September). There is no satisfactory technique for anticipating the occurrence of cloud bursts because of their small scale. A very fine network of radars is required to be able to detect the likelihood of a cloud burst and this would be prohibitively expensive. Only the areas likely to receive heavy rainfall can be identified on short range scale. Much damage can be avoided by way of identifying areas and the meteorological situations that favour the occurrence of cloud bursts. The north-west ward moving monsoon systems (low pressure areas/cyclonic circulations) after recurving over Rajasthan/north-west Madhya Pradesh and passing over HP are found to cause these cloud bursts. Ray *et al.* (2001) have studied land slides over India, including H.P. They have reported 12 incidences of land

slides in H.P. during 1983 to 1988. The topography of the state enhances the devastation caused by cloud bursts as the water flowing down the steep slopes brings debris, boulders and uprooted trees with great velocity damaging any structure which comes in their ways leading to significant loss of life and property. The aim of the present study is to identify the areas/regions which are vulnerable to cloud bursts.

2. As cloud bursts are highly localized and short lived phenomena, it is difficult to come across the observational data on all occasions. Recourse has, therefore, to be taken to the media reports on the occurrences of such phenomena. For the present study, two newspapers - the Tribune and the Indian Express - being published regularly from Chandigarh have been consulted to find out the events of clouds bursts and associated loss of life and property. Data for 12 years (1990 to 2001) have been considered for the study. Since cloud bursts generally do not occur outside monsoon (June-September) season, the study pertains to this period only. These reports, however, may not be exhaustive as it is possible that some of the incidences, particularly in the interior areas of the state, might have gone unreported. The information on location of rivers and tributaries has been taken from Attri (2000).

3. A total of 36 cloud bursts were reported in HP during the 12 years under study - about 3 incidences per year, with a maximum of 7 in the year 2000 and none in the years 1991, 1996 and 1998. Out of these 36 cloud bursts, 15 were reported from Kullu, 6 in Shimla, 4 in Kinnaur, 3 in Mandi, 2 each in Kangra & Chamba and 1 each in Solan, Sirmaur, Lahul & Spitti and Hamirpur districts. Total death toll due to these events has been reported to be 651. The spatial and seasonal variation of

TABLE 1

Spatial and temporal distribution of cloud bursts in Himachal Pradesh

District	Months				Total	Average	Probability of occurrence of cloud bursts
	Jun	Jul	Aug	Sep			
Kullu	2	4	7	2	15	1.25	More than one per year
Shimla	1	1	4	0	6	0.5	One in two years
Kinnaur	0	2	2	0	4	0.33	One in three years
Mandi	0	2	1	0	3	0.25	One in four years
Kangra	0	2	0	0	2	0.17	One in six years
Chamba	0	0	2	0	2	0.17	One in six years
Sirmaur	0	0	1	0	1	0.084	One in twelve years
Solan	0	0	1	0	1	0.084	One in twelve years
Lahul & Spitti	0	1	0	0	1	0.084	One in twelve years
Hamirpur	0	0	0	1	1	0.084	One in twelve years
Bilaspur	0	0	0	0	0	0	-
Una	0	0	0	0	0	0	-
Total	3	12	18	3	36		

cloud bursts are given in Table 1. The incidences of cloud bursts are more during the months of July and August than in June and September.

Different districts have been divided into four categories as given below based on the average period of occurrences of one event.

<i>Average period of occurrence of one event</i>	<i>Risk category</i>	<i>Districts</i>
One year or less	Very high	Kullu
2-5 years	High	Shimla, Kinnaur and Mandi
6-10 years	Moderate	Kangra and Chamba
10 years or more	Low	Solan, Sirmour, Lahul & Spitti and Hamirpur

No cloud bursts were reported from the districts of Bilaspur and Una during the period under study.

Study indicates that districts Kullu, Shimla, Kinnaur and Mandi are most vulnerable to these events. The physical barriers in the form of steep hills which contribute towards formation of cumulonimbus cloud leading to cloud burst are present in these areas and hence more cases of cloud bursts have been reported from there. Hence, these districts need special focus regarding making protective structures against falling debris in case of cloud bursts and other remedial measures such as relocating the habitations from vulnerable banks of rivers (both seasonal and perennial), *nullahs* and for taking other protective measures.

4. Following salient features have been revealed regarding cloud bursts in H.P. during monsoon season.

(i) Frequency of occurrences of cloud bursts is more in the months of July and August than in June and September.

(ii) Kullu district is most vulnerable to these events followed by Shimla, Kinnaur and Mandi districts. These areas need special attention during monsoon season.

(iii) Districts of Kangra, Chamba, Sirmaur, Lahul & Spitti, Solan, Hamirpur, Bilaspur and Una have been found to be least affected by cloud bursts.

References

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