## **One Day Awareness Workshop**

On

# "Snow Avalanche and Flood Hazards in Himachal Pradesh"

28<sup>th</sup> May, 2014







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Organized by:

# State Centre on Climate Change

(H.P State Council for Science Technology & Environment) Block-34, SDA Complex, Kasumpti, Shimla-9

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**Department of Revenue, Himachal Pradesh Government** 



## One Day Awareness Workshop on Snow Avalanche and Flood Hazards in Himachal

Pradesh on 28 May 2014 at Hotel Holiday Home, Shimla Organized by: State Centre on Climate Change (State Council for Science Technology & Environment) 34 SDA Complex, Kasumpti, Shimla-9

#### <u>Agenda</u>

	VENUE: <u>HOTEL HOLIDAY HOME</u>
09:00-10:00	Registration
10:15-10:20	Welcome Address <b>Dr.S.S.Negi,IFS ,Director (Env.)-cum- Member</b> Secretary(EC),State Council for Science Technology & Environment
10:20-10:50	Monitoring and prediction of extreme weather events over Kedarnath during June2013: <b>Dr Anand Sharma, Director IMD Uttrakhand Government.</b>
10:50-11:00	Inaugural Address-Sh.Tarun Sridhar, IAS, Pr. Secretary (Env.,S &T,Rev) to the Govt.of Himachal Pradesh
TEA	11:00- 11:30
Session I	11:30- 13:00
Rapporteurs:	Chairman Er.R.K.Sharma, Engineer –in-Chief, Irrigation & Public Health Deptt.Himachal Pradesh Mr.Arvind Bhardwaj, Mr.Ishant Rai, Ms.Kalpana Negi, Ms.Sangeeta Chauhan
11:30-12:00	Climate Induced Hazard threat in Himachal Pradesh – Issues, major gaps and the management : Dr.S.S.Randhawa, Senior Scientific Officer, State Centre on Climate Change (State Council for Science Technology & Environment, Shimla.
12:00-12:30	Initiatives on flood hazard management w.r.t. Himalayan Region <b>Dr. Anil Lohani, Scientist 'F"</b> National Institute of Hydrology (NIH) Roorkee, Govt. of India.
12:30-13:00	Flood Forecast Network in Himachal Pradesh <b>. Er.P.Dorjee Gyamba</b> , Director CWC Shimla.
13:00-13:30	Mountain Weather Prediction-A State of Art: Dr.Piyush Joshi, SASE Chandigarh.
LUNCH	13:30-14:15
Session II	TECHNICAL SESSION 14:15-15:00
	Chairman Dr.Anand Sharma, Director, IMD Dehradun
Rapporteurs:	Mr.Arvind Bhardwaj, Mr.Ishant Rai, Ms.Kalpana Negi, Ms.Sangeeta Chauhan
14:15-15:00	Snow Avalanche Mapping, Monitoring and Mitigation based on the Remote Sensing Techniques: <b>Dr.CS Kanda, SASE Chandigarh.</b>
15:00-15:45	Avalanche Early Warning Systems with special reference to Himachal Pradesh: <b>Dr.Amreek Singh, SASE Chandigarh.</b>
15:45-16:15	Preparedness for hazard threat in Himachal Pradesh: <b>Sh.Manas Dwivedi ,</b> <b>State Coordinator (DM) Revenue Department</b>
16:15-17:00	Discussions and Concluding Remarks.

## Proceedings of the One Day Awareness Workshop on Snow Avalanche and Flood Hazards in Himachal Pradesh on 28th May 2014 at Hotel Holiday Home, Shimla, H.P.

#### **Background:**

Mountain areas are especially vulnerable to natural disasters where development over the years has further accentuated the problem by upsetting the natural balance of various physical processes operating in the mountain eco-system. The increasing pressure on the mountain environment has contributed in some measure to environmental problems such as landslides, land subsidence, removal of vegetation and soil erosion. According to one estimate, about 58.36% of the land is subjected to intense soil erosion, majority of which is located in the Himalaya. Himachal Pradesh a small hilly state forms a part of the Northwestern Himalaya which are the youngest mountain chains in the world are still active and in the building phase. The environmentally fragile and ecologically vulnerable Himalayan part has rendered the state highly vulnerable and sensitive from the natural disaster point of view. Physiographically the state has been divided into three broad units viz. Lower or Outer Himalaya, Middle Himalaya and the Higher or Great Himalaya and each unit is susceptible to different types of hazards depending upon the lithological, soils and local climatic variations. The State also shows considerable variations in the distribution of rainfall and temperature due to the varying aspects and altitudes. Precipitation declines from west to east and south to north. The average annual rainfall is about 1111mm, varying from about 450 mm in Lahaul & Spiti to over 3400 mm in Dharamshala, the district headquarter of Kangra. About 70% of precipitation is received from July to September. Winter precipitation in the form of snow is received at elevation above 1800 m.

Natural hazards are matter of immediate concern to the State of Himachal Pradesh, as every year the State experiences fury of nature in various forms like earthquakes, landslides, cloud bursts, flash floods, snow avalanches and droughts etc. The fragile ecology of the mountain state coupled with large variations in physioclimatic conditions has rendered it vulnerable to the vagaries of nature. The incidence of cloudbursts in the last few years has baffled both the meteorologist and the common man equally. Notwithstanding, the continuous efforts made by the



Government to cope with natural hazards through relief and rehabilitation measures, landslides and snow avalanches continue to inflict widespread harm and damage to human life as well as property. The roads that are the State's lifeline are repeatedly damaged, blocked or washed away by one or other acts of nature. In the circumstances, the Government has to divert the already scarce resources of the state for relief and rehabilitation measures as opposed to long term development.

The state of Himachal Pradesh as a whole is vulnerable to different kinds of disasters, natural as well as man made in the nature. Some of the identified hazards or prognostic hazards in Himachal Pradesh are as under:



In view of the high vulnerability of the state to different kinds of hazards, the State Centre on Climate Change of the State Council for Science Technology & Environment planned to sensitize the stakeholder departments on the vulnerable threat of the natural hazards with special reference to the snow avalanche and flood hazards in the state and organized a one day workshop at Hotel Holiday Home on 28<sup>th</sup> May 2014 with the funding support of Revenue Department ,Government of Himachal Pradesh.



#### **Objectives:**

The workshop was organized with the objective to sensitize and create awareness amongst the stakeholder departments which are mainly involved in the flood and avalanche hazard management in the state and also the assess the state of art available as far as the management and mitigation of the avalanche and floods hazards is concerned.

#### Key speakers:

The key speakers were mainly from two intuitions mainly viz the National Institute of Hydrology (NIH) Roorkee which is the nodal agency as far as the flood management in the country is concerned and the Snow Avalanche Study Establishment (SASE) a DRDO Lab at Chandigarh which is the nodal agency for the avalanche management in the country. Besides this Central Water Commission (CWC) Regional office was also the key speakers in this workshop.

#### Target Audience:

About 100 officers from stakeholder departments like Irrigation & Public Health, Horticulture, Forest, HPSEB, SJVNL, HPPCL, Energy, Himurja, Health, Himachal

Institute of Public Administration (HIPA), State Disaster Management Authority (SDMA) NBPGR Shimla, ICAR Shimla, District Administration of Mandi, Lahaul & Spiti, Kinnaur, Shimla districts participated in the workshop.





### **SNOW AVALANCHE & FLOOD HAZARD VULNERABILITY**

#### Avalanche Hazard Vulnerability of the State:

An avalanche may be defined as the sudden downward motion of the snow mass which may contain rocks, soil, ice and trees. Avalanches have also the history of damage in Himachal Pradesh. The Higher Hills comprising the districts of Kinnaur, Lahaul and Spiti, Chamba, and Kullu are particularly vulnerable to the hazards of avalanches (Fig.1). The destruction caused as a result of avalanche in the past in Himachal Pradesh though not widespread is confined to higher reaches only. The prominent events of avalanche damage in Himachal Pradesh are as per Table 1 and the district wise breakup of avalanches in H.P. is given in Table 2.



![](_page_5_Figure_4.jpeg)

Location		Date/Year	Damage Occurred
Lahaul	and	Jan 1975	Earthquake shocks triggered the
Spiti			road net work
Lahaul	and	Mar 1978	About 30 people killed, road and property
Spiti			damaged.
		Mar 1979	About 237 people killed. Communication disrupted
Lahaul	and	Mar 1991	Tinku avalanche occurs every year 4-5
Spiti			times from Jan to March. Road was blocked for 40 days in 1991
		Sept.1995	Due to avalanche, huge chunk of debris came down which later changed into flood
Lahaul	and	Nov.1997	Along the Rani Nala, but fortunately there
Spiti			was no causality
Lahaul	and	March 2011	Pindri Nala, 2 laborers died
Spiti			

Table 1:	Avalanche Hazard and the damage occurred
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Source: SASE, DRDO, Chandigarh

## Table 2: Districts wise Breakup of the Avalanche Accidents in Himachal Pradesh

Sr.No.	District	No. of Accidents	Persons involved	Persons killed	Persons injured
1	Chamba	12	59	53	0
2	Kinnaur	32	144	129	9
3	Kullu	6	13	9	4
4	Lahaul & Spiti	21	397	298	53
5	Shimla	2	6	1	5

Source: SASE, DRDO, Chandigarh

#### Flood Hazard Vulnerability of the State

Floods are another form of natural hazards which the state experiences every year. Due to the diverse topography of the area, the flood problem in the state is largely isolated in nature. High monsoon rains in the area of the Shiwalik and Lower and Mid Himalayan ranges causes extensive floods during the rainy season. In the upper reaches of the Beas and Satluj valley, the main problems are flash floods and bank erosion because of steep slopes of rivers and High River flows due to heavy rains. Often the flash floods caused due to cloudbursts, glacial lake outbursts and temporary blockage of the river channels have been also observed. As

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a result of breaches in embankments and damage to various utilities like irrigation /flood control schemes and houses are also observed. The rivers which are prone and important from flood hazard point of view are as per the Table 3

Sr.No.	Vulnerable Rivers	Major Tributaries	
1	River Satluj	Spiti, Sangle khad, Ali khad, (khad, khad,Sir khad, and Swan river	Gambhar
2	River Beas	Uhl and Suketi khads	
3	River Ravi	Siul	
4	River Yamuna	Pabbar, Giri and Bata	

Table 3:	The Rivers o	f importance	from flood	damage angle	e
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Source: Vulnerability Atlas Himachal Pradesh

Although widespread floods problems do not exist in the state because of topographical nature, continuing attention is necessary to reduce flood hazards in the state. As per the available record during the floods of 1990, 89, 88, 85,78 and 1971, considerable damage was caused to housing and infrastructure. The history of damage occurred due to floods in the State is as per the Table 4.

![](_page_7_Figure_5.jpeg)

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# Table 4: Some of the devastating Floods in H.P. which caused heavy<br/>damages to Private, public as well as Government property

Sr. No.	Prominent Flash Floods	History of Damage Occurred
1	8 July 1973	Lake formed by the blockage of Satluj River due to Nathpa rock fall damaging Sanjay Vidyut Power House causing revenue loss of Rs.45 Million.
2	In Satluj basin two blockades were observed in Spiti valley. One on Parechoo River between Sundo and Kaurik during the landslide along the right bank created by 19Jan.1975 earthquake, which occurred along the Sumdo-Kaurik fault. Blockade was 60m and 150 length created temporary lake. In March this lake bursted causing flash floods in Spiti valley	
	On 29th Sept. 1988 (2.30 a.m.) a flash flood occurred due to cloud burst in Soldan khad causing huge damage to property.	Caused heavy loss of life and property in the Soldang village. Washed away 2 km of NH-22 across Soldan khad Washed away the Bhabanagar water works Created landslides along the eastern slopes of Soldan khad and damage road to Ponda Lake was formed on the Satluj river near confluence Block stopped the flow of Satluj river for about 30 minutes and created a temporary lake having dimensions roughly about 6000 m long, 200-250 m wide and 25-30 m deep extending up to Wangtoo bridge Lake water entered Sanjay Vidyut Pariyojna and damaged the Power House
3	Second occurred along Maling nalla due to Maling landslide debris between 31 <sup>st</sup> July and 2 <sup>nd</sup> August 1991.	Cloud burst and flash flood along Soldan khad in Satluj valley Flood washed away 15 houses, 35 bigha of agriculture land and about 600 apple trees in Soldang village. 32 persons and 35 cattle heads lost their lives. Flash flood and landsdlie on 2 <sup>nd</sup> August 1991 along Maling Nala in Lower Spiti valley damaged 1500m road section of NH-22 and washed awar agriculture land along Leo village situated downstream.

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24 Feb 1993 Satluj River blocked twice due to major landslide and rock fall near Jhakri amnd Nathpa damaging NH-22.	
Another flash flood occurred in two phases along Duling khad on 4 <sup>th</sup> & 5 <sup>th</sup> September causing	Huge debris formed a fan along Satluj river and formed a lake by partially blocking the river.
extensive damage in Tapri, district Kinnaur	Flash flood caused a heavy damage due to change in river course of Satluj from left to right bank and increased the toe and lateral erosion
First flash flood occurred on 4 <sup>th</sup>	at Tapri.
September 1995m at 2pm,. After cloudburst in the upper catchment of Duling and	Washed 19 houses ,HRTC workshop along with 3 buses
Damaged the PWD rest house.	Change in course is still causing toe erosion to NH-22
High magnitude floods have also recorded in Beas valley in 1902,45,93,95.	
Continuous anthropogenic pressure on existing Geo-Eco system has increased the severity and damaging impact of these flash floods.	
4 <sup>th</sup> & 5 <sup>th</sup> Sept.1995 flash flood in	Caused damage to the tune of Rs.759.8
Kullu valley	million. Heavy rains and flash floods caused water saturation along loose Quaternary deposits along slopes and excessive bank erosion which led to landslides in Kullu valley
February 1993	500m road section of NH-22 washed away by Jhakri slide.Rs.10 million loss to ropad and forest land , a village on the upper slope was in danger
Flash flood on the night of 31 <sup>st</sup> July and Ist August 2000 in Satluj valley	Flash flood in the SAtluj valley resulting in the increased water level of Satluj river upto 60feet above the normal level. The flash flood was termed as the one that occurs once in 61,000 years. Widespread damage in the valley right from its confluence with the with Spiti river near Khab to downstream areas. Extensive damage to 200 km of NH-22, washed away 20 bridges, 22 Jhulas and badly damaged 12 bridges. About 1000 irrigation, sewerages, flood protection and water supply schemes were badly damaged. Extensive damage to hydel projects including NJPC, 135 people and 1673 cattle lost their lives. The total estimated loss was to the tune of Ps 1466 26 Crerc

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Flash floods on the night of 22 <sup>nd</sup> July 2001 in Sainj valley in district Kullu 17 <sup>th</sup> & 19 <sup>th</sup> July 2001 floods in Mandi district Flash floods on the night of 29 <sup>th</sup>	Cloud burst in the upper reaches of Sainj valley caused flash floods in two nallahs viz. Sainj and Jeeba affecting about 40 families. 2 bridges on Sainj and Jeeba nallas and plenty of fertile land was washed away. Connecting road to Siund and Sainj was also washed away at a number of places. Two persons were washed away and 5 cattle perished. Some other areas in Kullu district were also affected due to excessive rains in July and population of 6355 was adversely affected. Excessive rains caused damage to 160 houses in Mandi district and destroyed 11 cattle and one person. Caused widespread damage in the area. 12 deaths accurred due to floop flood and lace of
Bhangal and Baijnath Sub Divisions of Kangra district	deaths occurred due to flash floods and loss of 150 cattle was reported from the area. Bridge connecting Deol and Baijnath was also washed away. Total estimated loss was to the tune of Rs.18.27 Crore.
Flash floods on the night of 9 <sup>th</sup> August and 10 <sup>th</sup> August 2001 on Moral-Danda peak in Rohru Sub- Division in Shimla District	Flash floods occurred along two streams , one along the Devidhar area and another along Darkali in Rampur Sub Division. Dameg to infrastructure like roads, bridges, agriculture land, horticulture land, footbridges, village paths, residential houses, and water mills and loss of 3 lives and 390 cattle and destruction of private property. Total loss in both the Sub Divisions was 145.15 lacs. In Rohru Sub Division 7 bridges, 8 village paths,8 water supply schemes, and 1 power house was damaged besides 16 houses, whereas in Rampur Sub Division, 10 bridges, 8 village paths, 1 water supply schems,1 soil conservation plant, 7 residential houses and 16 water mills were damaged.
Flash floods on the night of 21 <sup>st</sup> and 22 <sup>nd</sup> August 2001, cloud burst in Ani Sub Division of Kullu District	Due to flash flood in village Badhali 2, houses in which a couple was buried alive and their two children injured. In village Sarli 7 people lost their lives, 15 houses were washed away besides the loss of 12 cows, 18 oxen and 40 sheep and about 115 bighas of agriculture and horticulture land was washed away.
Flash floods in Slhunta area and Tissa areas of Chamba district on the night of 12-1th August 2001	Washed away 9 hectare of fertile land, 2 small bridges causing a total loss to property of Rs.2 corore.
Flash floods due to cloudbursts in Gharsa valley on 16 <sup>th</sup> July 2003 in Kullu district	Due to these flash floods 21 people lost their lives, 21 people suffered major injuries and 9 are missing
Flash floods in Kangni nala near Solang in Kullu district on 7 <sup>th</sup> August 2003	30 people lost their lives and 19 were injured and 9 people were missing.2 people lost lives due landslides in Bhang nala.
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breach in the Parechhu lake in Tibetan catchment on 26 <sup>th</sup> June 2005	level of Satluj river due to a breach in the Parechhu lake formed in Tibetan catchment. Washed away the NH-22 at a number of places, 10 bridges, 11 ropeways washed away, 15 motorable bridges and 8 jeepable and footbridges damaged/affected.10km stretch of Nyh-22 between Wangtoo and Sumdo was washed away and various link roads were damaged. Total loss estimated to the Govt. as well as public property was to the tune of 610 crore.
Flash floods during July 2005	Flash floods in Pabbar river in Rohru Sub Division resulted in heavy losses to roads, bridges, public buildings, residential houses, cowsheds, private land. Chirgaon block was totally cut off. On July 7, 2005, flash flood in Baspa river took place causing the loss of 6 bridges and 600 mt link road to Sangla. More than 3000 cattle perished in different parts of the state leading a total loss of Rs.55980.76 Lacs.
15 August 2007,Bhavi Village, Ghanvi Shimla District	58 persons died, all roads leading to village cut off.
7 August 2009,Dharmpur, Mandi District	2 persons died.

Source: Bhandari, 1988; Sah et al.1996, Sah & Mazari 1998; Sah and Bist 1998' Paul et al, 2000, revenue Department, Govt of Himachal Pradesh)

### **Inaugural Session:**

In the inaugural session, Principal Secretary (S&T., Rev) Government of Himachal Pradesh, IAS Sh.Tarun Sridhar, chaired the proceedings. The one day workshop began with the lighting of the lamp by the followed signatories by its formal inauguration worthy Principal by Secretary, Government Himachal of Pradesh.

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Dr. S.S. Negi, IFS, Director (Environment) GoHP – cum- Member Secretary (EC) State Council for Science Technology & Environment welcomed Sh. Tarun Sridhar, IAS, Principal Secretary (S&T, Rev) Govt. of Himachal Pradesh the chief guest

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and the distinguished speakers from NIH Roorkee, SASE Chandigarh and CWC Shimla. He also welcomed the distinguished participants from stakeholder departments like Irrigation & Public Health, Horticulture, Forest, HPSEB, SJVNL, HPPCL, Energy, Himurja, Health, Himachal Institute of Public Administration (HIPA), State Disaster Management Authority (SDMA) NBPGR Shimla, ICAR Shimla, District Administration of Mandi, Lahaul & Spiti, Kinnaur, Shimla districts Dr Negi in his welcome address emphasized on the importance of data generation on snow avalanches and flood hazards for making mitigation strategies. In order to achieve the objective, Dr. S.S. Negi gave his opinion that Himachal has to work with the neighboring states as well as neighboring countries like China, Nepal, Pakistan and

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Bhutan etc. regarding floods and avalanches hazards. He also pointed out the importance of sharing the data between various departments for making the mitigation strategies.

### Honouring of Speakers by the Chief Guest

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Dr. Anand Sharma, Director Indian Meteorology Department (IMD), State

Centre Uttrakhand in his key note address presented his views on the "Monitoring and prediction of extreme weather events over Kedarnath June during 2013". He informed the august gathering that the early warning with location specific and time was issued to the Government about 3-4

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days prior the tragedy based on analyzing the various weather phenomena over the region which was proved to be very accurate later on. He presented his views over various factors which were responsible for the drastic weather reactions over the region, which includes early arrival of monsoon, special orography of the region, and low pressure system over the Bay of Bangal which travelled over the Himalayas and reached over the Rajasthan. Further he presented the rainfall data from 13 to 18<sup>th</sup> June 2013 for the Uttarakhand and adjoining areas for better understanding of the situation which leads to Kedarnath tragedy. He further informed that the scientists cannot predict the flash floods 2-3 days before but it can only be predicted 2-3 hours in advance by continuously monitoring the metrological phenomene. He further informed that RADAR, Hydrological models and Mesoscale models can help in

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prediction of flash floods. He also suggested that the automatic weather stations along various altitudinal zones should be established to study the local weather phenomenon which will help in having proper mitigation strategies. He also highlighted the importance of traditional as well as modern

communication techniques. He further added that Government should encourage

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people not to do construction works along flood prone zones along the major rivers which will help minimizing the loss of life and property.

**Sh. Tarun Shridhar**, IAS, Pr. Secretary (Env. S & T, Rv) to the Govt. of H.P. in his inaugural address told that we have to develop specific strategies in order to manage all types of hazards in the State. Pr. Secretary was of the opinion that we should also involve the civil society and affected people in such type of workshops as they are the one who really needs exposure and awareness besides the Govt. agencies who are to be trained as far as the management of these hazards at the Govt. level is concerned. He was also of the opinion that we should not only restrict to the workshop level only but we have to come up with hazard specific actionable points which can be taken at the Govt. and at the public level so that the mandate for the proper management of the hazards is achieved. He also suggested for developing a strong communication system in case of the mountain environment as most of the communication tools will be failed in case of any disaster in the State.

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### **Technical Session: I**

**Chairman –** Er. R. K. Sharma, Engineer- in Chief, I&PH Dept. Himachal Pradesh

**Co-Chairman -** Er. Ashwani Gupta, Chief Engineer (Shimla Zone) Irrigation & Public Health Department.

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Dr. S. S. Randhawa, Senior Scientific Officer from State Centre on Climate Change presented his views on "Climate induced hazards in H.P., Issues, Major gaps and the Management. Major climate change induced issues includes mountain vulnerability due to flash floods, agriculture in state as most of the

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economy of the State is dependent the on agriculture which is mainly dependent on the rainfall which is very sensitive to climate induced changes in micro macro and environment. He also presented an overview on the warming trends and

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decrease in rainfall and snowfall in Shimla during past decade. He told that there is less snowfall in peak winter and more in later half of winter. He also told that Beas basin has shown decrease in discharge. He further presented an overview of snow and glacier studies and distribution of snowfields in Himachal Pradesh. He informed that there is about 19% glacier loss in Baspa basin during past few years. He told that in Spiti Himalayas glaciers are exposed i.e. they are not covered with debris and are more vulnerable. Based on the studies carried out in Spiti basins there is about 20% deglaciation between 1962-2001 and about 10% deglaciation occurred between 2001 and 2007. He further told that SCCC is regularly monitoring the GLOF from Mansarovar Lake to Himachal. He also presented an inventory of moraine dammed glacial lakes (GLOFs) in the Himachal Himalayan using satellite data for the year 2013 which includes Chenab, Beas, Ravi basins in Himachal Pradesh and the Satluj basin right from its origin from Mansarovar lake in Tibet Himalaya. He further told that there is increase in no of glacial lakes in Miyar basin which is a result of melting of glaciers. He also told that there is increase in the glacial lake areas. He pointed out some gaps in these studies e.g. sharing of database, integration of data base, long term dissemination etc.

Dr. Anil Lohani, 'F" Scientist (National Institute of Hydrology, Roorkee) gave his views on Initiatives on flood hazard management. He focused on the flood disaster

management

in

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Himalayan region. He described the causes of flash floods in Himalayan region i.e. ice jams, heavy rain, landslides, dam failure etc. Intense rainfall & glacial lake outburst are the main cause of floods in Himalayan region. He told that the intense rainfall and glacial lake outburst are the main causes of flash floods in Himalayan region. He also discussed the characteristics of flash floods. He further presented

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the idea of **Holistic flood management**. In this model 1<sup>st</sup> is Pre flood preparations which includes physical flood defence infrastructures; 2<sup>nd</sup> is Operations during floods which emphasized on the importance of involving the insurance sector in hazard management and 3<sup>rd</sup> is post flood responses. He told that real time forecasting and data transmission are very important factors for flash flood management practices. He further discussed about GLOF modelling techniques. For this he told that input data should be very accurate for proper forecasting. He also discussed the GLOF Simulation theory. For responding to these floods we should prepare inventory of glacial lakes and their mapping firstly. In his concluding remarks he told that network design, regular monitoring retrieval system & GIS for spatial data management is important one for preparedness toward natural disasters.

**Er. P. Dorjee Gyamba, Director CWC Shimla** gave his presentation on "**Flood Forecast System on Satluj in H.P.**" He gave a brief introduction on Floods and draughts in Himachal and India. He informed that during 2013 there was a loss of 2934 crores in Himachal due to floods. He also pointed that there are series of hydro electric projects over the Satluj River from China to India. He suggested that there should be a specific data sharing mechanism. He raised the issue of project dumping sites along river banks which can block the river channels and may lead to flash floods. He told that there are national highways and settlements along the river banks which

lead a greater loss life to and properties during floods. He told that Himachal Pradesh has multiplied its drainage area channels by between

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rivers to check the floods. He discussed about the telemetry based auto water level

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recorder. He told that our state has MOU with China Govt. to share the data on various factors leading to management of these hazards.

Dr. Piyush Joshi Scientist from Snow Avalanche Study Establishment (SASE) Chandigarh presented his views on "Mountain Weather Prediction – A state of art". He told about the importance of accurate weather predictions of various meteorological factors like temperature, pressure and precipitation etc. He further informed about how does atmosphere acts as a physical system. He raised various issues about challenges in specific snow forecast over the Himalayas. He discussed about two models i.e. NWP model and ANN model for avalanche forecast in the Himalayan region. ANN model i.e. Artificial Neural Network model include training and testing whereas NWP model gives forecast over a grid.

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#### Technical: Session II

Chairman – Dr. Anand Sharma, Director IMD Dehradun.

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Dr. C.S. Kanda, Scientist from Snow Avalanche Study Establishment (SASE) Chandigarh gave his presentation on Snow Avalanche Mapping and Mitigation based on the Remote Sensing technique. He gave a brief introduction on the remote sensing tool to mitigate avalanches. Further he discussed about the various factors responsible for avalanches to occur. He told about the mitigation methods which consisted of two kinds i.e. a) Passive which includes forecasting and awareness b) Active which includes controlled structure and controlled release. For

this GIS can be considered as an effective tool. For mitigating process there are three classes of factors Class I, II and III which includes stability factor, techniques snow packed and meteorological parameters. He emphasized on the importance of remote

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sensing in avalanche hazard prone areas. For studding this, he discussed about

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digital elevation models and digital avalanche atlases, avalanche hazard data cards. He also told about simulation of avalanche flow in GIS environment, application of GIS and GPS based studies and spatial decision support system for cryosphere monitoring in Himalayan region. He told that they had developed GPS based real time avalanche path warning and navigation system for Indian Army. This technique can also be helpful for the civil peoples in hazard sensitive areas. He also discussed about the terrain monitoring system which will flow on air borne system.

Dr. Amreek Singh, Scientist from Snow Avalanche Study Establishment (SASE) Chandigarh added to Dr. Kanda's views with his presentation on "Avalanche early warning systems with special reference Himachal to

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Pradesh". Firstly he briefed the house with his introduction to natural disasters in which he told that the floods contribute maximum to the natural hazards and avalanches contribute 1% of them. SASE has recorded 2100 avalanche prone sites in their area of action. He presented a data on the avalanches occurred in Himachal during last 10 years. He discussed about the ingredients of avalanches which include terrains, snow and slopes etc. Further he discussed the techniques for avalanche forecasting with the help of meteorological data. For which he suggested conventional methods with deterministic and probabilistic approaches. He also discussed the factors Class I, II and III which includes stability factor, snow packed techniques and meteorological parameters. He told that the IIIrd type i.e. meteorological parameter technique is widely in use against I & II factors which are field based analysis. He informed the audience to know about avalanche danger scales. He also told that their organization is providing the published literature for free about the avalanches and their impacts and mitigation strategies in the hazard sensitive areas.

![](_page_21_Picture_4.jpeg)

**Mr. Manas Dwivedi, State Coordinator (DM), Revenue Department, H.P** focussed his talk on "Preparedness for hazard threat in Himachal Pradesh. Firstly he highlighted the loss to life and property in flash flood disaster that struck Uttarakhand last year. He emphasized on the issue that there are no provisions of trauma support to the people who survives these disasters but have lost their family members and property due to which they are totally helpless and in deep distress. So there is an urgent need to make the trauma support an integral part of our disaster management plans so that such needful people may be helped to revive to their normal lifestyle and get back to normal routine of their life. He also highlighted the importance of Disaster Management Act 2005. He also informed that the disaster management plans for 7 districts has been completed for Himachal Pradesh and it will be soon completed for rest 5 districts.

![](_page_22_Picture_1.jpeg)

### **Concluding Session**

The concluding session was chaired by Dr. R.K. Sood, Professor & Head, Disaster Management, Himachal Institute of Public Administration (HIPA) Shimla. The speakers from the respective organisations like NIH, SASE, and CWC also participated in the discussions. A healthy and progressive discussion took place on the various issues on snow avalanche and flood hazards for their mitigation

![](_page_22_Picture_4.jpeg)

strategies which ended with concluding remarks of Dr. S.S. Negi, Director (Env. S&T) Govt. of Himachal Pradesh. Based on the deliberations and open discussions the following actionable points/ recommendations were made:

- 1. Highest priority should be given to relocation of vulnerable population from potential danger zones.
- 2. Follow up with IMD, Govt. of India for the installation of Radar / Automatic Weather Stations in H.P.
- Programs for dissemination of warning should be expanded and intensified. All weather communication should be developed. Tone alert hand winding FM community Radio may be promoted.
- 4. A comprehensive assessment of impacts of natural disasters on various ecosystems requires a multi sectoral and integral approach involving key organizations. Weather watch system for better coordination among various state and central departments /agencies should be created.
- 5. Weather forecast by multiple agencies (IMD / SASE / Universities) should be avoided.
- 6. Real time monitoring of vulnerable lakes may be undertaken.
- 7. Land use land cover changes to be monitored for better impact forecast.
- Community-wide awareness and education programs on natural disasters should be a priority. Capacity building at all levels (Capital/ district /Tehsil / village levels to be undertaken for better awareness / management.
- Construction of Shelters / alternate roads along yatra routes should be given top priority. Display systems for weather forecast / warnings may be established at strategic locations.
- 10. A system for Flash flood forecasting to be established.
- 11. Direct linkage with SASE and other agencies like DDMA and NDMA and state government for providing information on avalanche hazards.
- 12. Awareness campaign and mock drills in hazard prone areas should be done in time to time for checking the preparedness to combat the hazards.

![](_page_23_Picture_13.jpeg)

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![](_page_24_Picture_2.jpeg)

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SASE (DRDO)       SASE (DRDO)         51.       Sh. Shyam Singh Thakur ASCO (HIQ) Directorate of Agriculture, Shinla-5 (H.P.)       krishinidesh@yahoo.com       98167-72417         52.       Dr. A.K. Lohani Scientist "F"       aklnih@gmail.com       94129-28876         53.       Sh. V.S. Kamal       sdma_hp@nic.in       94180-20129         1/C DMC, H.P. Secretariat       sdma_hp@nic.in       94180-20129         54.       Dr. Manmohan Singh Director, IMD, Shimla       mm_sandhu@yahoo.co.in       98161-27668         55.       Dr. Manas Sharma EMEO, (Deptt of Sc. & Tech.), Shimla-2       mansharma007@gmail.com       80910-11107         56.       Sh. P.K. Gupta S.E. (D&W), O/o C.E. (M2), HPPWD, Mandi, (H.P.)       ergupta@yahoo.co.in       94184-50445         58.       Sh. D.C. Rana Addl. Secy. (Home)       saurabhsmljr@gmail.com       88944-84700         58.       Sh. UC. Rana Addl. Secy. (Home)       vinegi@yahoo.co.in       94184-50351         60.       Sh. Shubhash       prakash@dain.jagran.com       94182-50351         61.       Sh. Prakash Bhardwaj Daink Jagran       prakash@dain.jagran.com       94180-72904         62.       Sh. Mohan Lal Verma UNI, Shimla       seoprmp@gmail.com       94180-72904         63.       Sh. S.N. Upreti S.E. Op, HPSEBL Rampur       seoprm@gmail.com       94180-72904		Scientist "E"		
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107	Satish Kumar		93189-5545
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108	Vipin Kumar		98178-4959
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109	Dhyan Singh		98574-303
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110	Inderjeet Singh		98052-6109
	IT Professional		
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111	Neeraj		94185-4320
	IT Professional		
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112	Baldev Thakur		98160-6842
	IT Professional		
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113	Mast Ram		98176-002
	IT Professional		
	AGISAC, Panthaghati, Shimla		
114	Jai Prakash		98174-364
	IT Professional		
	AGISAC, Panthaghati, Shimla		
115	Naresh Kumar		
	IT Professional		
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116	Shasi Thakur		
	IT Professional		
	AGISAC, Panthaghati, Shimla		
117	Rajesh Kumar		98167-7553
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118	Sumit Kumar		94188-0430
	IT Professional		
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![](_page_29_Figure_1.jpeg)

119	Lalit Kumar	88948-63872
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120	Lekh Raj	97361-40991
	IT Professional	
	AGISAC, Panthaghati, Shimla	

![](_page_30_Figure_1.jpeg)