

Long term trend of heavy precipitation over northwest Himalayas

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Three zones of Himalayas

- Western Himalayas
- Central Himalayas
- Eastern Himalayas

Common Natural Hazards

- Western Himalayas: Heavy snowfall, avalanche, flash flood, cloud burst, earthquake...
- Central Himalayas: Heavy snowfall, heavy rainfall, Landslide, avalanche, cloud burst, earthquake....
- Seastern Himalayas: Thunderstorm, heavy rainfall, Landslide, earthquake





Cont...

- □ WHR experiences extreme weather conditions like heavy snowfall/rainfall and cloud bursts under the impact of WDs.
- □ These extra-tropical systems are identified as troughs/cyclonic circulations in the mid tropospheric westerlies, which originate from the frontal systems over Mediterranean and Caspian Sea areas and move eastwards producing severe weather over the Indian region.
- A WD give widespread heavy snowfall with extensive avalanche over western Himalaya, when a good amount of moisture incursion occur from Arabian Sea or Bay of Bengal or both in association with the movement of WD with an induced low to its south over northwest India.









Objective of study

To study the frequency of WDs and its relationship with monthly ppt over NWH using 25 surface observatories (including 22 observatories installed under project PARWAT) installed over this region

- To study the trend in frequency of rather heavy (>24.4 mm) and heavy (>64.4 mm) precipitation events over NWH.
- Also to study the trend in seasonal & annual precipitation over NWH.







1	S. No.	STATION NAME	Longitude		Latitude		Ht above	
			Deg	Min	Deg	Min	m.s.l	
	1.	Banihal Top	75	23	33	31	3250	All
	2.	Gulmarg	74	23	34	04	2800	observatories
	3.	Haddan Taj	74	03	34	19	3080	Enom 1 22
	4.	Stage-II	73	59	34	25	2650	From 1-22
	5.	Pharkiyan	74	05	34	35	2960	above neight
	6.	Kanzalwan	74	42	34	39	2440	2.4 km
	7.	Zamindarkhan-Gali	74	26	34	37	3100	
	8.	Drass	75	46	34	25	3250	
	9.	Puttakhan	74	09	34	35	2972	
	10.	Nastachun Pass	73	57	34	24	3128	
	11.	Ragni	73	55	34	28	3160	
	12.	Himmat	74	17	34	00	3697	
	13.	Sonapindi	74	19	34	42	3180	
	14.	Niru	75	02	34	34	2630	
	15.	Dawar	74	50	34	38	2414	
	16.	Pant	74	39	34	42	4040	
	17.	Sonmarg	75	18	34	18	2745	Sec. Contraction
	18.	Bimbat LC	75	49	34	26	4950	
	19.	Firm Base	75	40	34	32	4760	
	20.	Kaksar	75	59	34	35	2960	
	21.	Мор	74	02	34	35	4080	A
	22.	Gugaldar	74	09	34	37	3360	
	23.	Qazi Gund	33	35	75	05	1690	
A Bart Barto	24	Banihal	33	30	75	10	1630	
	25.	Srinagar भारत मौ	समु वि	a =05-1	विमा	50	1587	12.12.
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Monthly ppt over NWH





Around 65% of the annual precipitation (975.0 mm) occurs from Dec to April.

Around 22% of its annual ppt occurs in monsoon season (June- Sept), which is due easterlies or with its interaction with westerlies.

As the max ppt over NWH occurs in month of Feb, which is due maximum frequency of active WDs over the region.





Monthly ppt over Central Himalayas





Around 60% of the annual precipitation (1426 mm) occurs during monsoon and 31% from Dec-April over H. P. sector of Central Himalayas.

Around 81% of the annual precipitation (1658 mm) occurs during monsoon season and 12% from Dec-April over U. K. sector of Central Himalayas.



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Trend in precipitation over NWH with altitude



No uniform trend in ppt with altitude, however ppt is max between 3.0- 3.5 km.







Trend in precipitation over W & C H with altitude



Annual mean precipitation increases upto altitude 1.5 km and decrease thereafter (by using data of 44 surface observatories in J&K, HP and UK)



Trend in precipitation over NWH with altitude





Monsoon (monthly ppt) 423

250

2.5 to 3.0

2.0 to 2.5

321

.0 to 3.5

249

1.0 to 4.5

4.5

3.5 to 4.0

Post-monsoon (monthly ppt)



Seasonal mean precipitation increases with altitude in Winter & post-monsoon due to WDs which are mid-latitude westerlies systems. It is highest at lower latitudes in premonsoon and monsoon seasons because ppt is mainly due to low level easterlies.



450

400

350

300

250

200

150

100

50

0

272

1.5 to 2.0



% frequency of rather heavy precipitation



Around 65% of the annual frequency of rather heavy falls (12 per year) occurs from Dec to April in association with WDs over the region.



% frequency of heavy precipitation



Around 70% of the annual frequency of heavy falls (2 per year) occurs from Dec to April in association with WDs over the region.





Trend in frequency of R. heavy ppt (1962-2010)



No trend in NWH and Qazi Gund.

Around 10% increase in rather heavy events over SNG and 10% decrease in events over Banihal from their respective mean average from 1962-2010





R. heavy ppt over Srinagar(1962-2010)







Srinagar seasonal and annual precipitation



(A+7) E.R.

Around 15% increase in winter ppt and events during winter season And around 30% reduction in postmonsoon season ppt



R. heavy ppt over Banihal (1962-2010)



Around 20% decrease in rather heavy events during pre-monsoon and post-monsoon seasons.







Banihal seasonal and annual precipitation



R. heavy ppt over Qazi Gund (1962-2010)



Qazi Gund seasonal and annual precipitation





Trend in frequency of heavy ppt (1962-2010)



There is 12% and 25% decrease in frequency of heavy events over NWH and QZH from their respective mean for period 1962-2010.





Trend in frequency of R. heavy ppt (1901-2010)



There is 12% increase in frequency of Rather heavy events from the average based on period 1901-2010.





Trend in frequency of heavy ppt (1901-2010)





There is 20% increase in frequency of heavy events from the average based on period 1901-2010.





Seasonal and annual precipitation trend for 1901-2010





Conclusions:

- Around 65% of its total annual mean and heavy precipitation of NWH occurs between Dec to April, which is mainly associated with WDs over this region. Whereas, in central & Eastern Himalayas, most part of its total annual precipitation occurs in monsoon season.
- □ In spatial distribution in precipitation total annual precipitation in general increases upto 3.5 Km and maximum between 3.0 -3.5 km. In seasonal mean precipitation, precipitation increases with altitude in Winter & post-monsoon, whereas in other seasons, it is highest at lower latitudes.
- In long term trend for rather heavy events between 1962-2010, no trend is found NWH as a whole. However, increasing trend is found over Srinagar, which is around 10% of its annual mean of its rather heavy events between 1962-2010.

□ In seasonal basis, increasing trend in winter rather heavy events are found over all the stations. Over Srinagar, around 25% increase in rather heavy precipitation events are observed during winter and monsoon seasons. Around 20% and 25% decrease in R heavy events are observed during pre-monsoon over Banihal and Qazigund from their respective seasonal mean between1962-2010.





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Trend in annual frequency of heavy precipitation between 1962-2010 shows a decreasing trend over NWH as a whole, which is about 12% of its mean annual frequency of heavy events between 1962-2010. Station wise, Srinagar and Banihal shows a slight increasing trend. Qaji Gund shows a decreasing trend, which is about 25% of its annual mean between 1962-2010.

□ In long term trend between 1901 to 2010, Increasing trend is observed for rather heavy events, which is about 12% of its annual mean between 1901-2010.

□ For heavy events between 1901 to 2010, Increasing trend is observed, which is about 20% of its annual mean between 1901-2010.





