

**GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION NO. 2950
TO BE ANSWERED ON WEDNESDAY, 15TH DECEMBER, 2021**

FLASH FLOOD GUIDANCE SERVICES

2950. DR. RAMAPATI RAM TRIPATHI:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) whether India and the entire world is facing extreme weather conditions during the last few decades;
- (b) if so, the details of extreme weather conditions observed in the country during the last decade;
- (c) the location-wise estimated loss of lives and property in the said extreme weather conditions;
- (d) whether India Meteorological Department has introduced the Flash Flood Guidance Services to combat the situation of flash floods in the country; and
- (e) if so, the details of such locations in the country where infrastructure for such services has been set up?

ANSWER

**THE MINISTER OF STATE (INDEPENDENT CHARGE) FOR
MINISTRY OF SCIENCE AND TECHNOLOGY
AND EARTH SCIENCES
(DR. JITENDRA SINGH)**

(a) - (c) Yes Sir. There is an increase in the number of recorded disasters attributed to weather, climate and water hazards over the decade at Global level as per the Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970–2019) published by WMO (https://library.wmo.int/doc_num.php?explnum_id=10902). Following figure (Fig. 1) from this report shows that the number of disasters has increased by a factor of five over the 50 years period: whereas 711 disasters were recorded for 1970–1979, 3536 were recorded in 2000–2009 globally.

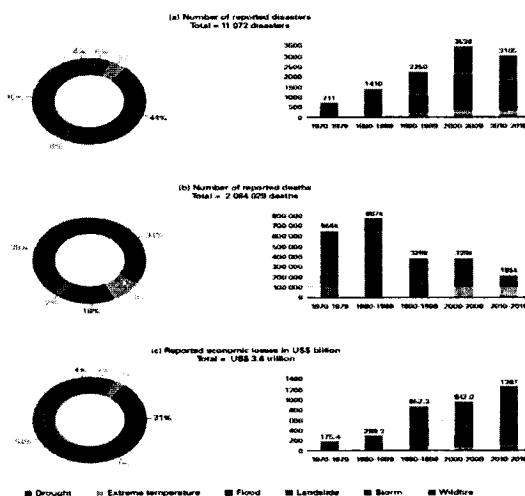


Fig 1. Distribution of (a) number of disasters, (b) number of deaths and (c) economic losses by hazard type by decade

As per recent WMO publication “State of the Climate in Asia 2020” (https://library.wmo.int/doc_num.php?explnum_id=10867.pdf) also reported extreme weather related hazard over South Asia. The details of number of people affected and damage due to extreme weather over the Asian Countries is given in Fig.2.

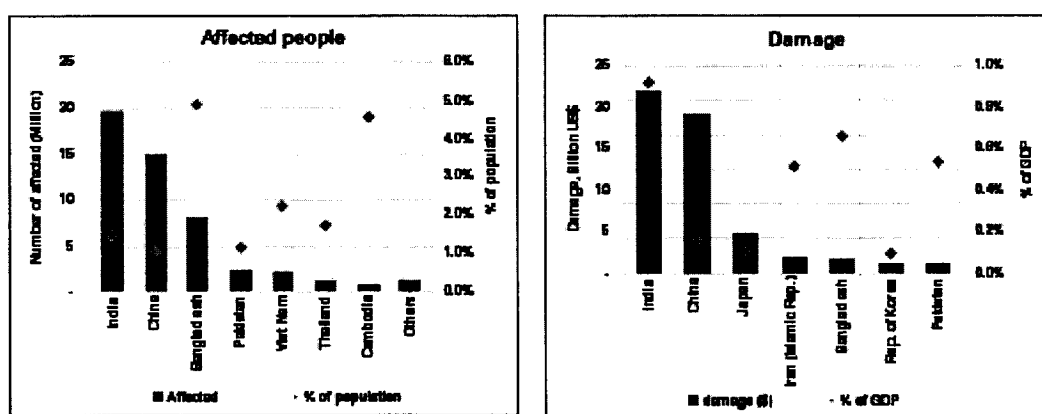


Fig.2 Affected people and damage by climate-related hazards in Asia in 2020. Source: CRED EM-DAT (data on people affected and damage by climate-related hazards); ESCAP Sustainable Development Goals Gateway Data (<https://dataexplorer.unescap.org>) (data on population and GDP)

Climate Research and Services, IMD, Pune every year brings out publication on disastrous weather events (<https://imd pune.gov.in/library/publication.html>). The detailed information of loss of lives due to various disastrous weather events which happened since 2010 in India is given in Table 1. The state wise loss/damage due to such events is provided in Table 2.

- (d) - (e) Recognizing the damage potential of flash floods and a general lack of flash flood warning capabilities, IMD in joint collaboration with the US National Weather Service, the US Hydrologic Research Center (HRC) and USAID/OFDA has developed a Flash Flood Guidance System (FFGS) for South Asian region. The FFGS has been in operational mode since October 2020.

The Flash Flood Guidance is a robust system designed to provide the necessary products in real-time to support the development of warnings for flash floods about 6-24 hours in advance at the watershed level with resolution of 4kmx4km for the flash flood prone South Asian countries viz. India, Nepal, Bhutan, Bangladesh and Sri Lanka, covering most of the Himalayan region. Hydrology Division in IMD, New Delhi is the designated and recognised regional center by WMO for issuing the flash flood guidance for these countries. The Infrastructure for the services is set up in IMD, New Delhi.

The flash flood guidance value is a diagnostic value that estimates the amount of rainfall of a given duration within a watershed that is required to produce flooding at the outlet of the catchment/ watershed. Flash flood guidance is issued for about 1 lac watersheds of the country on daily basis.

Table.1 The loss of lives due to various disastrous weather events which happened since 2010 in India.

DEATHS TO DISASTROUS WEATHER EVENTS FOR THE YEAT 2020-2021

NATURAL EVENTS	1	2	3	4	5	6	7	8	9	10	11		
YEAR	शनिवार / SNOWFAL	शीत लहर / COLD WAVE	उष्ण / HEAT WAVE	शुष्क / SQUAL	शुष्क / GAL	धूलि / DUST	शुष्क / LIGHTNIN	तड़कें / THUNDER STORM	आतंजन / HAILSTOR	बाढ़ और शरीर्षा / FLOODS AND HEAVY RAINS	चक्रवाती / CYCLONI C STORM	TOTAL (WHOLE YEAR)	REMARK
YEAR	SNOWFAL	COLD WAVE	HEAT WAVE	SQUAL	E GAL	DUST STOR	G LIGHTNIN	M THUNDER STORM	M HAILSTOR	FLOODS AND HEAVY RAINS	CYCLONI C STORM	TOTAL (WHOLE YEAR)	REMARK
2021	12	7			4	5	655	26	1	745	172	1627	UPDATED TILL 6 DEC 2021
2020	22	162	11	6	12	14	270	594		758	115	1964	
2019	65	291	495	3	5	25	202	349	2	921	71	2429	
2018	18	280	33		8	237	342	572	8	1099	157	2754	
2017	38	51	375	15	10	5	834	287	4	1075	46	2740	
2016	22	42	510	8	3	11	670	216	28	714	34	2258	
2015	12	18	2081	1	5	30	498	324	39	917	94	4019	
2014	62	58	547	9	3	51	352	246	35	953	46	2362	
2013	30	271	1433	1	3	1	326	327	54	5528	50	8024	
2012	31	139	729	5	5	5	434	190		395	61	1994	
2011	14	722	12		4	21	177	331		654	46	1981	
2010	25	450	269		3	41	431	373	45	1058	22	2717	

Table.2 The state wise loss/damage of lives due to various disastrous weather events which happened since 2010 in India

DISASTROUS WEATHER EVENTS happened during the year 2021 (UPDATED TILL 6 DEC 2021)												
Sum of Deaths	Natural Events											
State	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & HEAVY RAINS	GAL E	HAILSTORM	LIGHTNING	SNOW FALL	THUNDERSTORM	Grand Total		
Andhra Pradesh		4		46						50		
Assam				14						14		
Bihar		1		12			58		15	86		
Chhattisgarh							1			1		
Goa		3								3		
Gujarat		79		7			6			92		
Haryana							1			1		
Himachal Pradesh				55				4		59		
Jammu & Kashmir	2			21		1	4	4		32		
Jharkhand		3					26			29		
Karnataka		8		33			3		1	45		
KERALA		9		53			5			67		
Madhya Pradesh				34	1		111		2	148		
MAHARASHTRA		56		215			73		2	346		
Odisha		4		3	3		203			213		
Rajasthan							42			42		
Sikkim				2						2		
Tamil Nadu				20			14			34		
TELANGANA		3		15			7			25		
UNION TERRITORY (NEW DELHI)	3			4						7		
UTTAR PRADESH	2		5	42			43		6	98		
UTTARAKHAND				143				4		147		
West Bengal		2		26			58			86		
Grand Total	7	172	5	745	4	1	655	12	26	1627		

DISASTROUS WEATHER EVENTS OF 2020

State	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & HEAVY RAINS	GAL E	HAILS TORM	HEAT WAVE	LIGHTNING	SNOW FALL	SQUALL	THUNDERSTORM	Grand Total
Andhra Pradesh		9		21				20				50
ARUNACHAL PRADESH				11								11
ASSAM				129								129
Bihar	54			54			2				280	390
CHHATTISGARH								14			11	25
Gujarat				29				8				37
HARAYANA				1								1
Himachal Pradesh				38					4			42
JAMMU & KASHMIR				13	3			5	17			38
Jharkhand	16			4				5		6	126	157
KARNATAKA				148	1			12				161
Kerala				79	8		1	2			1	91
MADHYA PRADESH				10				72			7	89
Maharashtra		4		59			8	41			1	113
MEGHALAYA				6								6
Odisha		4		16				16				36
Puducherry												
Punjab												
Rajasthan	3		14	18				4				39
Sikkim				5					1		1	7
Tamil Nadu		12						9				21
Tamil Nadu, Puducherry, Andhra Pradesh												
Tamil Nadu, Puducherry, Kerala												
Telangana				61				6				67
UNION TERRITORY (NEW DELHI)				1								1
UTTAR PRADESH	88			48				53			167	356
UTTARAKHAND	1			4								5
West Bengal		86		3				3				92
Grand Total	162	115	14	758	12		11	270	22	6	594	1964

DISASTROUS WEATHER EVENTS OF 2019

State	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & HEAVY RAINS	GA LE	HAILS TORM	HEAT WAVE	LIGHT NING	SNOWFALL	SQUA LL	THUNDERST ORM	Grand Total
ANDHRA PADESH							45					45
ASSAM							15				11	120
Bihar							293				72	690
Chhattisgarh							2				17	23
GOA												1
Gujrat											10	42
Haryana												
Himachal Pradesh								8				34
Jammu & Kashmir						0		57			3	82
JHARKHAND	13						13			2	126	159
Karnataka								21			8	59
Kerala					2		13					94
MADHYA PRADESH	12				2		30				2	65
MAHARASHTRA	7						53				64	265
Manipur											3	3
Odisha		64						24		1		89
Punjab												
Rajasthan			25				3				15	130
SIKKIM												1
Tamil Nadu					1							19
TELANGANA					2		66					85
Tripura											1	1
Utter Pradesh							9				64	357
Utterkhand												33
West Bengal											17	32
Grand Total	291	71	25	921	5	2	495	202	65	3	349	2429

DISASTROUS WEATHER EVENTS OF 2018

State	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & HEAVY RAINS	GA LE	HAILS TORM	HEAT WAVE	LIGHT NING	SNOWFALL	SQUA LL	THUNDERST ORM	Grand Total
Andhra Pradesh		24		10				15				49
Arunachal Pradesh				4								4
Assam				51				1			11	63
Bihar	121										89	210
Chhattisgarh							2	7			19	28
GUJARAT				32								32
HIMACHAL PRADESH				24								24
Jammu & Kashmir				18	3			2	18			41
Jharkhand	19						3				140	162
Karnataka				13	4			5			29	51
Kerala				478			1	3			3	485
MADHYA PRADESH	1		7	8		1		18				35
MAHARASHTRA	3			45		7	16	32				103
MANIPUR				7								7
MIZORAM				1								1
NAGALAND				12								12
Odisha		81		21				147				249
Punjab				13							2	15
Rajasthan	1		74	26			2	31			1	135
Tamil Nadu		52		6				1				59
Telangana								2				2
TRIPURA				6								6
Union Territory (NEW DELHI)					1							1
UTTAR PRADESH	135		150	308			9	72			163	837
UTTARAKHAND			6	13								19
WEST BENGAL				3				6			115	124
Grand Total	280	157	237	1099	8	8	33	342	18		572	2754

DISASTROUS WEATHER EVENTS OF 2017

State	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS AND HEAVY RAINS	GA LE	HAILS TORM	HEAT WAVE	LIGHT NING	SNOWFALL	SQUA LL	THUNDERST ORM	Grand Total
ANDHRA PRADESH					1		236	24				260
Arunachal Pradesh				15								16
Assam				147			4	2				174
Bihar				105	2		84	5				271
Chhattisgarh				27			7				20	54
GUJARAT				288			2					290
Himachal Pradesh	10			67			7			1		85
Jammu & Kashmir				15	1		3	35			6	60
Jharkhand						4	5				61	70
KARNATAKA				58	4		61				7	130
KERALA		40		18	2							60
Madhya Pradesh	1					2	35					38
Maharashtra				28			16	102				146
MANIPUR				2								2
Manipur												
MEGHALAYA				5								5
MIZORAM		1										1
Nagaland				2								2
Odisha				4			17	408			4	433
Rajasthan	1			33			21					60
SIKKIM				3								3
Tamil Nadu		5		20	2		16				12	55
Telangana							100	9			13	122
TRIPURA				8								8
Uttar Pradesh	39			138			37				33	247
Uttarakhand				14			1	3				18
WEST BENGAL				78			2	8			7	130
Grand Total	51	46	5	1075	10	4	375	834	38	15	287	2740

DISASTROUS WEATHER EVENTS OF 2016

State	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & HEAVY RAINS	GALE	HAIL TORM	HEAT WAVE	LIGHTNING	SNOWFALL	SQUALL	THUNDERSTORM	Grand Total
Andaman & Nicobar							49	5			4	81
Andhra Pradesh												30
Assam										4	36	94
Bihar	16					10		60			10	180
Chhattisgarh	1						5	9		4	7	38
Gujrat							34					115
Himachal Pradesh											2	19
Jammu & Kashmir					2			1		10		31
Jharkhand	4							13			94	129
Karnataka							5	10				25
Kerala					1		26	2				41
Leh									12			12
Madhya Pradesh	1					1	3	102			7	162
Maharashtra							26	31				138
Mizoram												8
Odisha						6	20	244				272
Rajasthan		3						41				79
state							2					2
Tamil Nadu		33					4	6				48
Telangana						1	324	5			17	403
Tripura		1						4				5
UNION TERRITORY (DELHI)	7							5				12
UNION TERRITORY (Puducherry)							1	1				2
Utter Pradesh	9					10		123			26	225
Uttarkhand								1				62
West Bengal	4						11	7			13	45
Grand Total	42	34	11	714	3	28	510	670	22	8	216	2258

DISASTROUS WEATHER EVENTS OF 2015

Grand Total	THUNDERSTORM	SQUALL	SNOWFALL	LIGHTNING	HEATWAVE	HAILSTORM	GALE	FLOODS & HEAVY RAINS	DUSTSTORM	Cyclonic Storm	COLDWAVE	Grand Total
1570	37			19	1422			92				1570
2								2				2
131	70			7				54				131
163	123	1		21		17		2				163
57				53				3				57
77					7			70				77
31				4				22		5		31
65				5				60				65
26	25					1						26
127				85		1	5	36				127
32				2				30				32
48				29	2			16		1		48
110		1		60		3		46		20		110
20												20
5								5				5
188	2			121	50			10		5		188
11								11				11
145				38	2			78	25		2	145
59								59				59
259				24				235				259
632	34			9	584			5				632
2								2				2
100	16			18		17		34	5		10	100
5				1				1				5
154	16			11	14			44		69		154
4019	324	1	12	498	2081	39	5	917	30	94	18	4019

UNION TERRITORY(PUDUCHERRI)

DISASTROUS WEATHER EVENTS OF 2014

	GOLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & Heavy Rains	GA LE	HAILS TORM	HEAT WAVE	LIGHT NING	SNOWFALL	SQUA LL	THUNDER STORM	Grand Total
Andaman & Nicobar												
Andhra Pradesh	46		4		3	25	141	18			5	242
ARUNACHAL PRADESH			1									1
Assam			91				4				22	117
Bihar			48				28			1	34	111
Chhattisgarh			5	9		2	11	25			9	61
Gujarat							3					3
Haryana	4											4
Himachal Pradesh			23				1	10				34
Jammu & Kashmir			202					29				231
Jharkhand		10					2				53	65
Karnataka			58				113			1		172
Kerala			56				4			1		62
Madhya Pradesh	3		23				35					63
Maharashtra	1		157			6	36	62				262
Manipur						1						1
MEGHALAYA			45									45
Odisha			64				24	21			11	120
Punjab	3		22									25
Rajasthan	8		24				6	18				63
Tamil Nadu			12				9			4	7	32
Telangana			4				306				7	317
Union Territory (DELHI)	9											9
Uttar Pradesh	30		27					2				153
Uttarakhand				16				23				39
West Bengal						1	19	10		2	98	130
Grand Total	58	46	51	953	3	35	547	352	62	9	246	2362

DISASTROUS WEATHER EVENTS OF 2013

Row Labels	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & Heavy Rains	GA LE	HAILS TORM	HEAT WAVE	LIGHT NING	SNOWFALL	SQVA LL	THUNDERST ORM	Grand Total
ANDAMAN & NICOBAR ISLAND			1									1
Andhra Pradesh		12		77		43		40			22	194
Andhra Pradesh & Telangana							1393					1393
Assam			6				12	29			5	52
Bihar	42			53				17			44	156
Chhattisgarh				5							15	20
Gujarat				16			6					22
Haryana	2											2
Himachal Pradesh			26					3	14			43
Jammu & Kashmir			24					4	16			44
Jharkhand	29		4			6		17			77	133
Karnataka			43					36		1		80
Kerala			47					1				48
Madhya Pradesh	3		23			1	3	29				59
Maharashtra	3		100		2	6	3	52				166
Meghalaya						3					3	6
MIZORAM			17									17
Odisha		38	6				1	48			24	117
PUDUCHERRY				3								3
Punjab	2											2
Rajasthan	7		10			1	5	36				60
Sikkim					1							1
Tamil Nadu			23					9				32
Tripura											1	1
UNION TERRITORY (NEW DELHI)				1								1
Uttar Pradesh	170			43				5				218
UTTARAKHAND				5000								5000
West Bengal	13						4				136	153
Grand Total	271	50	1	5528	3	54	1433	326	30	1	327	8024

DISASTROUS WEATHER EVENTS OF 2012

Row Labels	COLD WAVE	CYCLONIC STORM	DUSTSTORM	FLOODS AND HEAVY RAINS	GALE TORM	HAILS TORM	HEAT WAVE	LIGHTNING	SNOWFALL	SQUALL	THUNDERSTORM	Grand Total
Andhra Pradesh	7	44	72	19	26						9	177
ARUNACHAL PRADESH			9									9
Assam			153								60	213
Bihar	5		12	8	3						21	49
CHHATTISGARH			1	3							3	7
Coastal Andhra Pradesh, Rayalseema and Telangana				347								347
Gujarat			32	3							15	50
Haryana		2									4	6
Himachal Pradesh			20	1	9							30
Jammu & Kashmir				5			1	22				28
Jharkhand	87		5	104							39	235
Karnataka			5	27						5		37
Kerala			26	13								39
Madhya Pradesh	1		9	13								23
Maharashtra				7	26						3	36
Manipur											13	13
Odisha				53	120							173
Punjab			1	14								15
Rajasthan	1	3	2	15								21
SIKKIM			25									25
Tamil Nadu		17		7							1	25
Tripura			1								1	2
Uttar Pradesh	34		3	31	22						5	95
UTTARAKHAND			15									15
West Bengal	4		4	143	157						16	324
Grand Total	139	61	5	395	5		729	434	31	5	190	1994

DISASTROUS WEATHER EVENTS OF 2011

State	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS AND HEAVY RAINS	GA LE	HAILS TORM	HEAT WAVE	LIGHT NING	SNOW FALL	LL	SQUA	THUNDERST	ORM	Grand Total
Assam				23								35		58
Bihar	288			7				4				62		361
Chhattisgarh	1		4	6				26				3		40
Gujrat				165				3						168
Haryana			2											2
Himachal Pradesh				24										24
Jammu & Kashmir	4			14				5	13			4		40
Jharkhand		295		22				10				82		409
Karnataka				13	2			35				4		54
Kerala				20	2		1	3						26
Madhya Pradesh	4			49				9						62
Maharashtra	5			59			3	42				1		110
Odisha	1			26			8	10	1			50		96
Punjab				17				5						22
Rajasthan		4		28				3						35
Tamil Nadu				74				8						82
Tamil Nadu & Pnonducherry		46												46
UNION TERRITORY (DELHI)				1										1
Uttar Pradesh			15	85				2				43		242
Uttrakhand				7				2						9
West Bengal				11				10				47		91
Grand Total	722	46	21	654	4		12	177	14			331		1981

DISASTROUS WEATHER EVENTS OF 2010

Row Labels	COLD WAVE	CYCLONIC STORM	DUST STORM	FLOODS & HEAVY RAINS	GA LE	HAILS TORM	HEAT WAVE	LIGHT NING	SNOWFALL	SQUA LL	THUNDERST ORM	Grand Total
ANDHRA PRADESH		17	14									31
ARNACHAL PRADESH			27									27
ASSAM			55								53	108
Bihar		189	7			37	3	108			164	508
Bihar and Jharkhand		90							4			90
CHHATTISGARH		4	245				57					306
Gujarat		17	9									26
Haryana												8
HIMACHAL PRADESH			8									223
JAMMU & KASHMIR		2	193				3	25				104
Jharkhand		28					16				60	55
Karnataka			23					27				79
Kerala			58					20			1	14
MADHYA PRADESH			2				3	9				409
MAHARASHTRA			159		2	1	96	151				1
Mizoram			1									1
Nagaland								1				41
Odisha		11	10				31					20
Punjab			9									100
Rajasthan		4	30				29	37				160
TAMIL NADU	5		120		1			33			1	12
TRIPURA			1			4					7	4
UNION TERRITORY (Chandigarh)		4										157
UTTAR PRADESH		100					16					19
UTTAR PRADESH / UTTARAKHAND												38
Uttrakhand												149
WEST BENGAL		1	7			3	18	38			82	2717
Grand Total	450	22	41	1058	3	45	269	431	25		373	