### GOVERNMENT OF INDIA MINISTRY OF EARTH SCIENCES LOK SABHA UNSTARRED QUESTION No. 2141

## TO BE ANSWERED ON WEDNESDAY, SEPTEMBER 23, 2020

### RISE IN INCIDENCE OF CYCLONES AND FLOODS

#### 2141. DR. KRISHNA PAL SINGH YADAV:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) whether there has been unprecedented increase in the natural calamities like cyclones and floods in the country during the last three years;
- (b) if so, the details thereof;
- (c) the details of the natural calamities like floods that occured in Madhya Pradesh during the said period; and
- (d) the steps taken by the Government to further improve the forecasting system to tackle such situation?

# ANSWER MINISTER FOR SCIENCE AND TECHNOLOGY AND EARTH SCIENCES (DR. HARSH VARDHAN)

(a) & (b) Yes Sir. Based on the statistics during 1891-2017, on an average 5 cyclones develop over North Indian Ocean in a year with 4 developing over Bay of Bengal and 1 over Arabian Sea. However, in the recent past increase in frequency had been observed in formation of cyclones in the North Indian Ocean. Also studies show an increase in frequency of severe cyclones over Arabian Sea in recent years.

The details of Cyclones formed over North Indian Ocean during 2017 to 2019 follow:

	Frequency o	f Cyclones over	Total	Intensity with that of
YEAR			number of	Severe Cyclones or
	Arabian Sea	Bay of Bengal	cyclones	more
2017	1	2	3	2
2018	3	4	7	6
2019	5	3	8	6

The occurrence of 5 cyclones over Arabian Sea in 2019 against the normal of 1 per year equals the previous record of 1902 for the highest annual cyclone frequency over Arabian Sea. Also 2019 witnessed development of more intense cyclones over Arabian Sea.

Regarding flood, it is mentioned that, the country has witnessed intense to very intense rainfall activity leading to flood scenario in the recent past. The number of stations reported Very Heavy and Extreme Heavy rainfall in the last three years, from 2017 to 2019, follow:

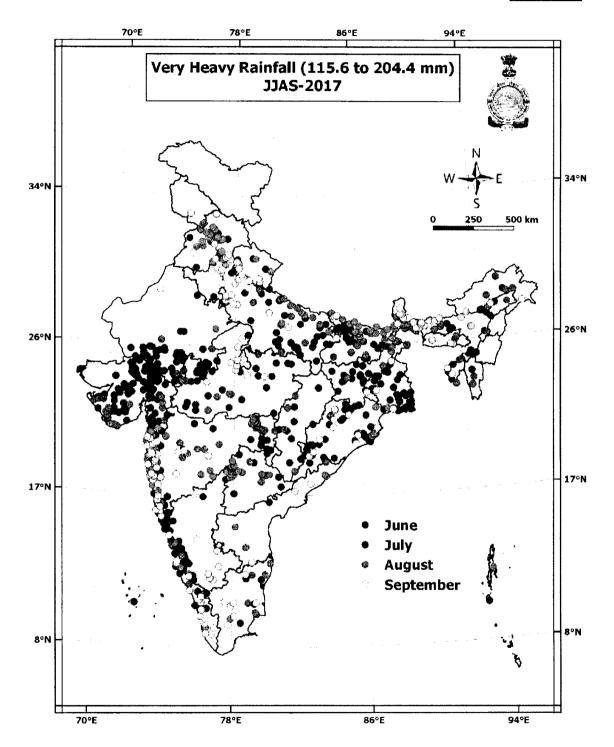
	Number of stations reported during SW Monsoon season (June to September)							
YEAR	Very Heavy Rainfall (115.6-	Extremely Heavy Rainfall (204.5 mm or						
	204.4 mm)	more)						
2017	1824	261						
2018	2181	321						
2019	3056	554						

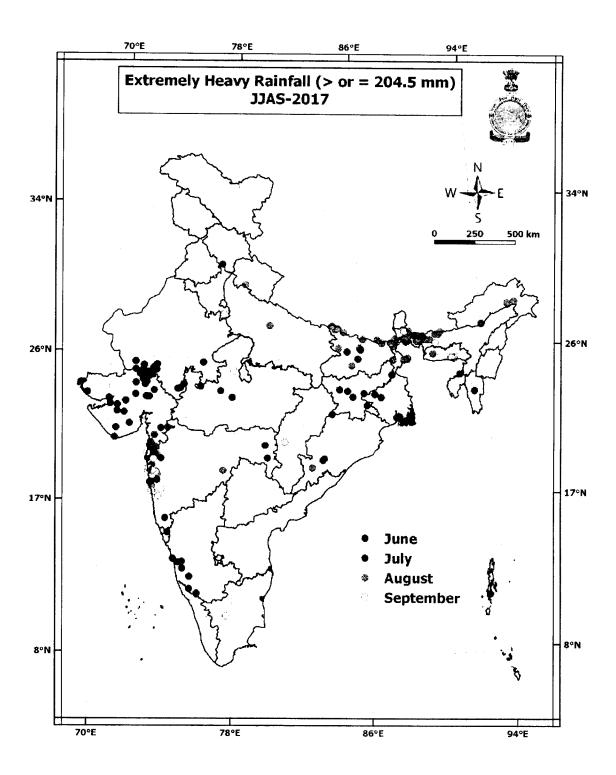
The data shows that there is a steady increase in the number of heavy rainfall events during the last three years. The spatial map of location of Very Heavy & Extremely Heavy Rainfall reported stations for the years 2017, 2018 and 2019 are attached separately as **Annexure I, II** and **III**, respectively.

- (c) Details of the natural calamities like floods in Madhya Pradesh during the last three years are given in <u>Annexure IV</u>. These are mainly based on media reports, received through State Meteorological Centres.
- (d) IMD uses a suite of quality observations from satellites, radars and conventional & automatic weather stations for monitoring of cyclones and prediction of weather. It includes INSAT 3D, 3DR and SCATSAT satellites, Doppler Weather Radars (DWRs) along the coast and Automated Weather Stations (AWS), Automatic Rain Gauges (ARGs), meteorological buoys and ships. Operational implementation of improved suite of prediction models has enhanced the weather forecasting capability through assimilation of all available global satellite radiance & Radar data for the production of forecast products at 12 km grid globally and 3 km grid over India/regional/mega city domains.

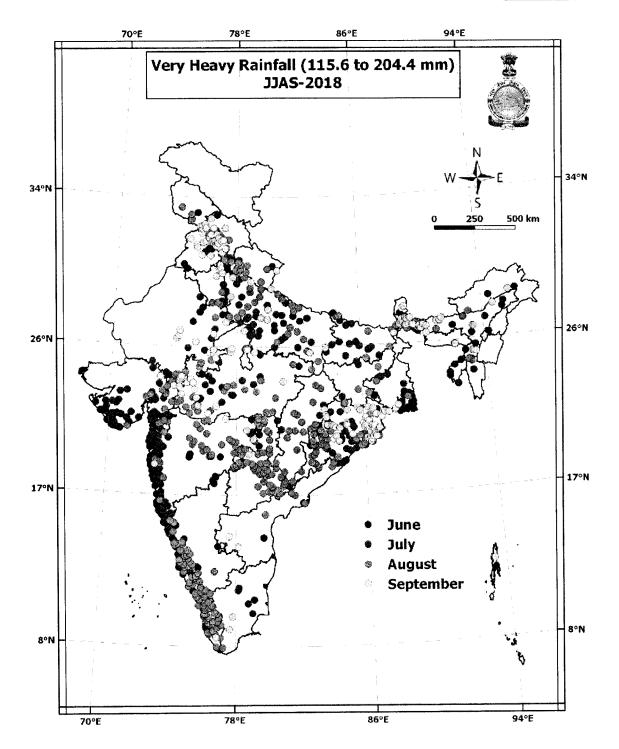
Further improvements in the observational network and numerical modelling are in progress under the scheme Atmosphere & Climate Research – Modelling Observing Systems & Services (ACROSS) for betterment of forecasting natural disasters like cyclone and heavy rainfall with respect to accuracy, lead time and spatial resolution.

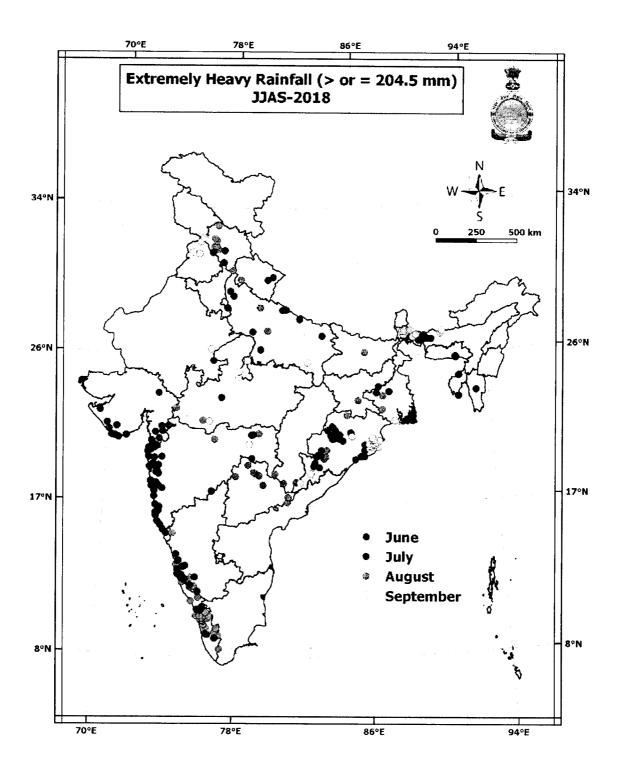
## Annexure-I



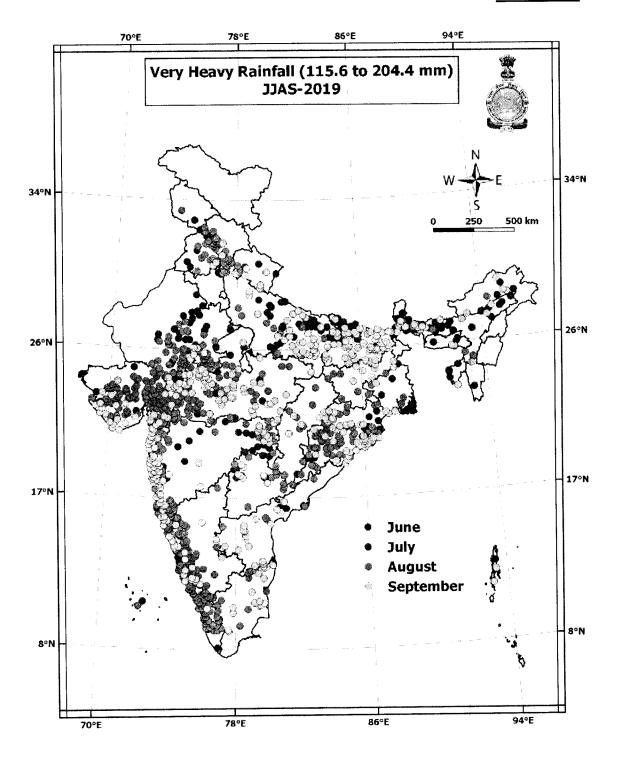


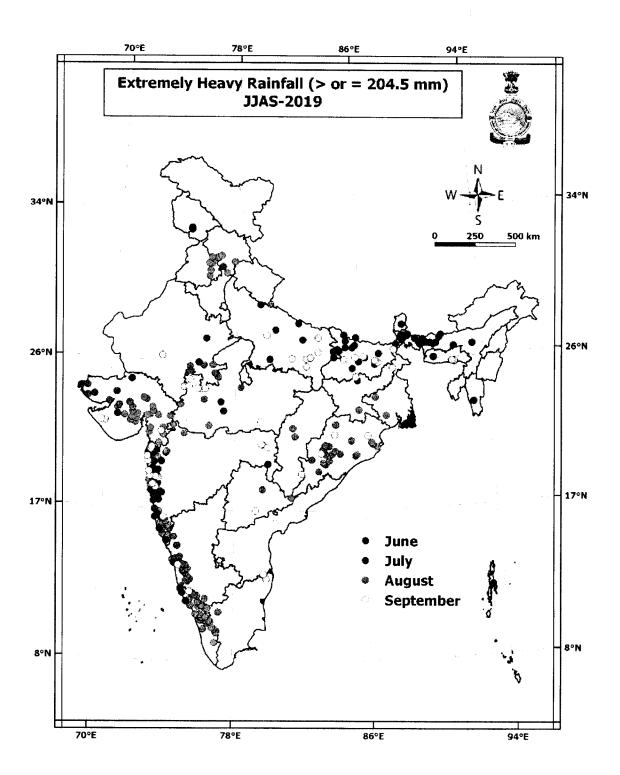
## Annexure-II





## Annexure-III





### Annexure IV

				Year 2017				
Da	ite						Hui	man
From	То	No-of Days	State	District	Natural Events	Intensit y	Deaths	Injurie s
13/01/2017	13/01/2017	1	Madhya Pradesh	Indore	Coldwave	severe (A)	1	
						Total	1	
11/02/2017	11/02/2017	1	Madhya Pradesh	Raisen	Lightning		1	
11/05/2017	11/05/2017	1	Madhya Pradesh	Sagar	Lightning		3	2
28/05/2017	28/05/2017	1	Madhya Pradesh	Sagar	Lightning		3	
23/06/2017	23/06/2017	1	Madhya Pradesh	Chhindwara	Lightning		4	
25/06/2017	25/06/2017	1	Madhya Pradesh	Mandsaur	Lightning			
26/06/2017	26/06/2017	1	Madhya Pradesh	Bhopal	Lightning		1	2
28/06/2017	28/06/2017	1	Madhya Pradesh	Dindori	Lightning		13	
28/06/2017	28/06/2017	1	Madhya Pradesh	Bhind	Lightning	,		
28/06/2017	28/06/2017	1	Madhya Pradesh	Tikamgarh	Lightning			
28/06/2017	28/06/2017	1	Madhya Pradesh	Sheopur	Lightning			
28/06/2017	28/06/2017	1	Madhya Pradesh	Satna	Lightning	,		-
19/07/2017	19/07/2017	1	Madhya Pradesh	Videsha	Lightning			·
19/07/2017	19/07/2017	1	Madhya Pradesh	Guna	Lightning			
19/07/2017	19/07/2017	1	Madhya Pradesh	Raisen	Lightning			
12/09/2017	12/09/2017	1	Madhya Pradesh	Shivpuri	Lightning		1	3
19/09/2017	19/09/2017	1	Madhya Pradesh	Umaria	Lightning		3	5
						Total	29	12
						Total in 2017	30	12

				Year 2018			1	
Da	ite	27.0					Hu	man
From	То	No-of Days	State	District	Natural Events	Intensity	Deaths	Injurie s
22/6/2018	22/6/2018	1	Madhya Pradesh	Khargone	Floods And Heavy Rains	Heavy rains	1	
12/7/2018	12/7/2018	1	Madhya Pradesh	Burhanpur	Floods And Heavy Rains	Heavy rains	1	
12/7/2018	12/7/2018	1	Madhya Pradesh	Harda	Floods And Heavy Rains	Heavy rains		
17/7/2018	17/7/2018	1	Madhya Pradesh	Bhopal	Floods And Heavy Rains	Heavy rains	1	
4/9/2018	4/9/2018	1	Madhya Pradesh	Bhind	Floods And Heavy Rains	Flood in Besla river	6	
22/9/2018	22/9/2018	ı	Madhya Pradesh	Khandwa	Floods And Heavy Rains	Floods & Heavy rains	1	
						Total	10	
1/10/2018	1/10/2018	1	Madhya Pradesh	Tikamgarh	Cold Wave	Severe A	1	
						Total	1	
13/02/2018	2/13/2018	1	Madhya Pradesh	Bhopal	Dust Storm		1	
19/03/2018	3/19/2018	1	Madhya Pradesh	Rajgarh	Dust Storm			
02/05/2018	02/05/2018	ı	Madhya Pradesh	Balaghat	Dust Storm		6	
02/05/2018	02/05/2018	1	Madhya Pradesh	Barwani	Dust Storm			
02/05/2018	02/05/2018	1	Madhya Pradesh	Betul	Dust Storm			
02/05/2018	02/05/2018	1	Madhya Pradesh	Bhind	Dust Storm			
02/05/2018	02/05/2018	1	Madhya Pradesh	Bhopal	Dust Storm			
02/05/2018	02/05/2018	1	Madhya	Burhanpur	Dust			

			Pradesh		Storm	+		
02/05/2019	02/05/2019	1	Madhya	Clabataman	Dust			
02/05/2018	02/05/2018	1	Pradesh	Chhatarpur	Storm			
02/05/2019	02/05/2019	1	Madhya	Chhindrean	Dust			
02/05/2018	02/05/2018	1	Pradesh	Chhindwara	Storm			
02/05/2018	02/05/2018	1	Madhya	Damoh	Dust			
02/03/2018	02/03/2018	1	Pradesh	Damon	Storm			:
02/05/2018	02/05/2018	1	Madhya	Datia	Dust			
02/03/2018	02/03/2018	1	Pradesh	Dalla	Storm			
02/05/2019	02/05/2019	1	Madhya	Dawas	Dust	·		
02/05/2018	02/05/2018	1	Pradesh	Dewas	Storm			
02/05/2010	02/05/2010	1	Madhya	Dlan	Dust			
02/05/2018	02/05/2018	1	Pradesh	Dhar	Storm			
00/07/0010	00/05/0010		Madhya	D. 1 .	Dust			
02/05/2018	02/05/2018	1	Pradesh	Dindori	Storm			
00/00/00/0			Madhya		Dust	· · · · ·		
02/05/2018	02/05/2018	1	Pradesh	Guna	Storm			
	0010010010		Madhya		Dust			
02/05/2018	02/05/2018	1	Pradesh	Gwalior	Storm			
			Madhya		Dust			†
02/05/2018	02/05/2018	1	Pradesh	Harda	Storm			
			Madhya	Hoshangaba	Dust			<u> </u>
02/05/2018	02/05/2018	1	Pradesh	d	Storm			
			Madhya		Dust	•		<del> </del>
02/05/2018	02/05/2018	1	Pradesh	Indore	Storm			
	<u> </u>		Madhya		Dust			1
02/05/2018	02/05/2018	1	Pradesh	Jabalpur	Storm			
			Madhya		Dust			
02/05/2018	02/05/2018	l	Pradesh	Jhabua	Storm			
			Madhya		Dust			
02/05/2018	02/05/2018	1	Pradesh	Katni	Storm			
			Madhya		Dust			
02/05/2018	02/05/2018	1	Pradesh	Khandwa	Storm			
			· · · · · · · · · · · · · · · · · · ·		Dust		-	
02/05/2018	02/05/2018	1	Madhya Pradesh	Khargone	Storm			
			Madhya		Dust			
02/05/2018	02/05/2018	1	Pradesh	Mandla	Storm			
		-	Madhya		Dust		<del>                                     </del>	<del> </del>
02/05/2018	02/05/2018	1	Pradesh	Mandsaur	Storm			
			ļ		Dust			
02/05/2018	02/05/2018	1	Madhya	Morena				
			Pradesh		Storm	70-4-1	<del>                                     </del>	<del> </del>
			N4 - 11			Total	7	
11/02/2018	11/02/2018	1	Madhya	Bhind	Lightning		8	2
		<u> </u>	Pradesh				<b> </b>	+
11/02/2018	11/02/2018	1	Madhya	Chhatarpur	Lightning			
		-	Pradesh	1	-		<del> </del>	
11/02/2018	11/02/2018	1	Madhya	Chhindwara	Lightning			
		<del> </del>	Pradesh				1	
11/02/2018	11/02/2018	<u> </u>	Madhya	Datia	Lightning	L		

			Pradesh					
11/02/2018	11/02/2018	l	Madhya Pradesh	Harda	Lightning			
11/02/2018	11/02/2018	1	Madhya Pradesh	Morena	Lightning			
11/02/2018	11/02/2018	1	Madhya Pradesh	Sagar	Lightning			
11/02/2018	11/02/2018	1	Madhya Pradesh	Sheopur	Lightning			
13/02/2018	13/02/2018	1	Madhya Pradesh	Katni	Lightning		2	
13/02/2018	13/02/2018	1	Madhya Pradesh	Dindori	Lightning			
11/04/2018	11/04/2018	1	Madhya Pradesh	Mandsaur	Lightning		2	
23/06/2018	23/06/2018	1	Madhya Pradesh	Betul	Lightning		1	
26/06/2018	26/06/2018	1	Madhya Pradesh	Seoni	Lightning		5	
						Total	18	2
11/02/2018	2/11/2018	1	Madhya Pradesh	Bhopal	Hailstorm	Moderate	1	
11/02/2018	2/11/2018	1	Madhya Pradesh	Guna	Hailstorm	Moderate		
11/02/2018	2/11/2018	1	Madhya Pradesh	Raisen	Hailstorm	Moderate		
11/02/2018	2/11/2018	1	Madhya Pradesh	Rajgarh	Hailstorm	Moderate		
11/02/2018	2/11/2018	1	Madhya Pradesh	Videsha	Hailstorm	Moderate		
21/10/2018	10/21/2018	1	Madhya Pradesh	Chhatarpur	Hailstorm	Heavy		
						Total	1	
						Total in 2018	37	2
		·		YEAR 2019				
Da	ate						Hui	
From	То	No-of Days	State	District	Natural Events	Intensity	Deaths	Injurie s
8/1/2019	8/1/2019	1	Madhya Pradesh	Rajgarh	Floods And Heavy Rains		1	
8/13/2019	8/13/2019	1	Madhya Pradesh	Alirajpur	Floods And Heavy Rains		3	

8/13/2019	8/13/2019	1	Madhya Pradesh	Burhanpur	Floods And Heavy Rains			
8/18/2019	8/18/2019	1	Madhya Pradesh	Bhopal	Floods And Heavy Rains		5	
8/18/2019	8/18/2019	1	Madhya Pradesh	Ratlam	Floods And Heavy Rains			
8/18/2019	8/18/2019	1	Madhya Pradesh	Sagar	Floods And Heavy Rains			
8/30/2019	8/30/2019	1	Madhya Pradesh	Raisen	Floods And Heavy Rains			
9/8/2019	9/8/2019	1	Madhya Pradesh	Bhopal	Floods And Heavy Rains		2	
9/8/2019	9/8/2019	1	Madhya Pradesh	Sehore	Floods And Heavy Rains			
9/9/2019	9/9/2019	1	Madhya Pradesh	Sehore	Floods And Heavy Rains		6	
9/9/2019	9/9/2019	1	Madhya Pradesh	Seoni	Floods And Heavy Rains			
9/30/2019	9/30/2019	1	Madhya Pradesh	Seoni	Floods And Heavy Rains		3	
						Total	20	ļ
1/27/2019	1/27/2019	1	Madhya Pradesh	Videsha	Cold Wave	Severe (A & C as appropria te)	2	
12/27/2019	12/27/2019	1	Madhya Pradesh	Datia	Cold Wave	Severe (A & C	3	

			, , , , , , , , , , , , , , , , , , , ,								
						as .					
						appropria					
						te) Severe					
						(A & C					
12/27/2019	12/27/2019	1	Madhya	Rewa	Cold	as					
12/2//2019	12,2,,2019	•	Pradesh	110 // 0	Wave	appropria					
						te)					
						Severe					
					0.11	(A & C					
12/29/2019	12/29/2019	1	Madhya Pradesh	Bhind	Cold Wave	as	1				
			Pradesn		wave	appropria					
						te)					
						Severe					
			Madhya		Cold	(A & C					
12/29/2019	12/29/2019	1	Pradesh	Videsha	Wave	as					
			1 Tudosii		,,,,,,	appropria					
						te)					
						Severe					
12/20/2010	12/20/2010	1	Madhya	Bhind	Cold	(A & C	6				
12/30/2019	12/30/2019	1	Pradesh	Brina	Wave	as	О				
						appropria te)					
						Severe					
						(A & C					
12/30/2019	12/30/2019	12/30/2019	12/30/2019	12/30/2019	1	Madhya	Guna	Cold	as		
12/30/2019					12/30/2019	12/30/2019	12/30/2017	12/30/2017	•	Pradesh	Guna
						te)					
					· · · · · · · · · · · · · · · · · · ·	Severe					
		30/2019	N4-	Madlana		Cold	(A & C				
12/30/2019	12/30/2019		Madhya Pradesh	Harda	Cold Wave	as					
						appropria					
						te)					
						Severe					
			Madhya		Cold	(A & C					
12/30/2019	12/30/2019	1	Pradesh	Mandla	Wave	as					
			1144511		,,,,,,,	appropria					
						te)					
						Severe					
12/20/2010	12/20/2010	1	Madhya	Shahdol	Cold	(A & C					
12/30/2019	12/30/2019	1	Pradesh	Shandor	Wave	as appropria					
						te)					
	-		<u> </u>			Severe					
	12/30/2019					(A & C					
12/30/2019		1	Madhya	Shivpuri	Cold	as					
12/30/2017	12,50,2017	2019   1	Pradesh	P	Wave	appropria					
						te)					
						Total	12				
2/14/2019	2/14/2019	1	Madhya	Chhatarpur	Lightning		3				

			Pradesh				<del></del> .	
2/14/2019	2/14/2019	1	Madhya Pradesh	Damoh	Lightning			
3/17/2019	3/17/2019	1	Madhya Pradesh	Seoni	Lightning		1	
4/16/2019	4/16/2019	1	Madhya Pradesh	Indore	Lightning		10	
4/16/2019	4/16/2019	1	Madhya Pradesh	Khargone	Lightning			
4/16/2019	4/16/2019	1	Madhya Pradesh	Ratlam	Lightning			
4/16/2019	4/16/2019	1	Madhya Pradesh	Shajapur	Lightning			
4/16/2019	4/16/2019	1	Madhya Pradesh	Sheopur	Lightning		_	
4/17/2019	4/17/2019	1	Madhya Pradesh	Sehore	Lightning		4	
4/17/2019	4/17/2019	1	Madhya Pradesh	Chhatarpur	Lightning			
4/17/2019	4/17/2019	1	Madhya Pradesh	Barwani	Lightning			
5/5/2019	5/5/2019	1	Madhya Pradesh	Nimach	Lightning		1	
5/12/2019	5/12/2019	1	Madhya Pradesh	Mandla	Lightning		1	
5/12/2019	5/12/2019	1	Madhya Pradesh	Rewa	Lightning			
5/12/2019	5/12/2019	1	Madhya Pradesh	Katni	Lightning			
6/28/2019	6/28/2019	1	Madhya Pradesh	Burhanpur	Lightning		3	
7/31/2019	7/31/2019	1	Madhya Pradesh	Bhopal	Lightning		1	
12/12/2019	12/12/2019	1	Madhya Pradesh	Raisen	Lightning		2	
12/12/2019	12/12/2019	1	Madhya Pradesh	Videsha	Lightning			
						Total	26	
12/12/2019	12/12/2019	1	Madhya Pradesh	Satna	Thunderst orm			
					and the continue of the first of the continue	Total	0	
1/24/2019	1/25/2019	2	Madhya Pradesh	Chhindwara	Hailstorm	Moderate		
1/24/2019	1/25/2019	2	Madhya Pradesh	Satna	Hailstorm	Moderate		
1/24/2019	1/25/2019	2	Madhya Pradesh	Seoni	Hailstorm	Moderate		
1/24/2019	1/25/2019	2	Madhya Pradesh	Singrauli	Hailstorm	Moderate		

1/24/2019	1/25/2019	2	Madhya Pradesh	Umaria	Hailstorm	Moderate		
2/14/2019	2/14/2019	1	Madhya Pradesh	Agar-malwa	Hailstorm	Moderate	, , , , , , , , , , , , , , , , , , , ,	
2/14/2019	2/14/2019	1	Madhya Pradesh	Datia	Hailstorm	Moderate		
2/14/2019	2/14/2019	1	Madhya Pradesh	Guna	Hailstorm	Moderate		
2/14/2019	2/14/2019	1	Madhya Pradesh	Mandsaur	Hailstorm	Moderate		
2/14/2019	2/14/2019	1	Madhya Pradesh	Shajapur	Hailstorm	Moderate		
2/27/2019	2/27/2019	1	Madhya Pradesh	Bhind	Hailstorm	Moderate	2	
2/27/2019	2/27/2019	1	Madhya Pradesh	Datia	Hailstorm	Moderate		
2/27/2019	2/27/2019	1	Madhya Pradesh	Morena	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Burhanpur	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Chhatarpur	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Chhindwara	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Damoh	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Datia	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Dewas	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Dhar	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Dindori	Hailstorm	Moderate		·
3/2/2019	3/2/2019	1	Madhya Pradesh	Guna	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Gwalior	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Harda	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Hoshangaba d	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Indore	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Jabalpur	Hailstorm	Moderate		
3/2/2019	3/2/2019	1	Madhya Pradesh	Jhabua	Hailstorm	Moderate		

3/2/2019	3/2/2019	1	Madhya Pradesh	Katni	Hailstorm	Moderate		
3/15/2019	3/15/2019	1	Madhya Pradesh	Dindori	Hailstorm	Moderate		
12/12/2019	12/12/2019	1	Madhya Pradesh	Agar-malwa	Hailstorm	Moderate		
12/12/2019	12/12/2019	1	Madhya Pradesh	Sheopur	Hailstorm	Moderate		
						Total	2	
						Total in 2019	60	