

ANALYSIS OF HAZARD OCCURRENCES WITH RESPECT TO RAINFALL IN MIZORAM



Published by:-
State Climate Change Cell
Mizoram Science, Technology & Innovation Council

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Analysis of Hazard Occurrences with respect to Rainfall in Mizoram

Mizoram State Climate Change Cell

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PREFACE

The whole state of Mizoram, locating in the adjoining areas of the southern foothills of the eastern Himalayas is characterised by series of hill ranges running from north to south with rough terrain with steep slopes and deep valleys. According to the report of Mizoram Remote Sensing Application Centre (MIRSAC), more than 70% of the state geographical area is under 35 percent slope or more. The region also receives heavy rainfall with average annual rainfall of more than 2500 mm. Furthermore, according to the State of Forest Report 2019, Mizoram has a forest cover of 85.41% out of which only 0.74% are under very dense forest which subsequently decrease to 84.53% in 2021 assessment due to anthropogenic activities. As such, the state of Mizoram is indeed no doubt vulnerable to climate variability and long-term climate change.

As per different published studies, over the past three decades, the climate of Mizoram has been experiencing changes which includes rising temperature and changes in temporal and spatial distribution of rainfall. The effects of such changes have been evident in the increase events and intensity of climate related hazards and disasters in the state which can be perceived by a common man even without the support of scientific data. Therefore, the State Climate Change Cell feel the need to examine such climate related hazards and disaster events and their relations with meteorological data by analysing recorded data from local sources. The result of this study is published in the report entitled “Analysis of Hazard occurrences with respect to rainfall in Mizoram”.

We feel that this report will provide useful information for decision makers and planners of the state. We also believed that it will be useful for academicians, researchers and students as well as an awareness material for the general public.

We thank the State Meteorological Centre, Directorate of Science and Technology, Government of Mizoram for providing their valuable data without which this report would not have been possible.

Place: Aizawl
Date: 12th April, 2022

(Er. H. LALSAWMLIANA)
Chief Scientific Officer & Member Secretary
Mizoram Science, Technology & Innovation Council

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Introduction

The tropical regions extending up to the tropics of both the hemisphere are proverbially prone to natural hazards such as, floods, hailstorms, cyclones, and landslides compounded with high rainfall intensity. Much research that has been done and published reveals that the criterion for shallow landslide to occur is high daily rainfall. As such, it is very critical to understand the rainfall threshold for such disaster to occur and thus model an early warning system. Rainfall is a recognized trigger of landslides, and this explains why there is a vast scientific literature on the relationship between rainfall and landslide occurrence. At regional and global scales, empirical rainfall thresholds are among the most used tools for the prediction of rainfall-induced slope failures. Several authors have proposed different methods for the calculation of rainfall thresholds through the statistical analysis of empirical distributions of rainfall conditions that have presumably resulted in landslides including cumulated event rainfall vs. rainfall duration or mean rainfall intensity vs. rainfall duration (e.g., Aleotti, 2004; Guzzetti et al., 2007, 2008; Brunetti et al., 2010; Berti et al., 2012; Giannecchini et al., 2012; Martelloni et al., 2012; Peruccacci et al., 2012; Staley et al., 2013; Segoni et al., 2014; Rosi et al., 2016; Galanti et al., 2017).

Asia (the site of the highest number of events; 75 % of landslides), with substantial numbers of landslides along the Himalayan Arc, in states across India and south-eastern China, in the neighbouring countries of Laos, Bangladesh and Myanmar, and southwards on islands that form Indonesia and the Philippines (Froude, M. J. & Petley, D. N, 2018).

Though rainfall is well known to be the major triggering factor for most of the landslides, antecedent rainfall can be a critical factor in cases of low intensity rainfall for a long period. In the last two decades, several efforts have been made by local, regional, national, and international organizations to design, implement, and maintain digital landslide inventories and thematic databases at the national scale in different countries (Dikau et al.1996; GSI 2005; Glade and Crozier 1996).

Within our country a few studies have been attempted to provide information to meet identified management objectives, there has been less effort spent on the provision of a systematic information base. In India there is no centrally organised landslide database, although some initiatives have been taken at the local level that cover localized areas. In hilly

states like Mizoram, early-warning system is an essential requirement for landslide prone localities as it could reduce losses and casualties that accompany natural hazards.

Study area

Mizoram is one of the North Eastern States of India, located in 21°56' and 24°31' N latitude and 92°16' and 93 ° 26' E longitudes with the geographical area of 21,081 sq. km having population of 10,97,206. It is bounded by Bangladesh and Tripura state, India in the West and Myanmar in the East and South, Manipur and Assam state, India in the North. Owing to its geographic, geological and physical features, Mizoram is vulnerable to all-major natural hazards such as cyclones, earthquakes, landslides, etc. The geology of Mizoram comprises N-S trending anticlinal strike ridges with steep slopes, narrow intervening synclinal valleys, dissected ridges with deep gorges, spurs and keels. Faulting in many areas has produced steep fault scarps (GSI, 2011). The present study aims at identifying various natural hazards which can affect the state of Mizoram.

Data collection

The state of Mizoram as any other north-eastern states is lacking in systematic information database for natural hazard occurrence and reporting. As such, data of natural hazard occurrence in Mizoram was collected primarily from various newspaper, news channels, face-book special report pages, whatsapp groups and other various sources. A total of three years (2019 – 2021) data was collected for analysis. Rainfall data was obtained from State Meteorological Centre, Directorate of Science & Technology, Government of Mizoram. The data consists of 34 years (1986-2019) record from 8 stations located in each of the district headquarters of the state.

Methodology

There have been many attempts to establish rainfall thresholds on global, regional, and at local scales which compare analysis at various levels. Rainfall thresholds anticipate landslide occurrence and help in issuing a warning to civil authorities and the general population. The use of rainfall threshold analysis for determining early warning systems have been established from other studies (Glade et al., 2000; Guzetti et al., 2008; Brunetti et al., 2010).

A scatter plot analysis is conducted for 2, 3, and 5-day antecedent rainfall vs. daily rainfall. This process resulted in the derivation of rainfall threshold equation for each condition of antecedent rainfall, from the known data for landslide occurring days in the form of a linear equation

$$y = mx + c \quad (1)$$

where y is the daily rainfall and x is the antecedent rainfall whereas m and c are constants representing slope and y intercept, respectively. The equation is further used to generate a graphical rainfall threshold exceedance curve. The exceedance of the rainfall threshold value for each antecedent rainfall condition during a given time interval is subsequently plotted. If the values are positive, it indicates possible triggering of a landslide. A graphically derived rainfall threshold exceedance curve can determine whether a landslide is plausible based on the rainfall data recovered over a time interval (Canovas et al., 2016).

Results

Rainfall threshold analysis was obtained for the study area during this study using data from landslide events within greater Aizawl area. Rainfall data for each landslide event totalling 270 days (15.05.2019 – 13.09.2021) is selected *viz.*, ten days before the landslide, on the day of landslide, and ten days after the landslide (Table 1). Additionally, 2, 3, and 5-day antecedent rainfall was obtained for all the 270 days. Adapting from Sajinkumar *et al.* (2014, 2015, 2016, 2017), the antecedent rainfall was limited to a maximum of five days. Scatter plots were generated for 2, 3, and 5-day antecedent vs. daily rainfall.

Of the three different trend lines obtained, the 5-day antecedent vs. daily rainfall trend line has the most landslide event (7) above the trend line and hence this trend line has been selected as the rainfall threshold equation for the study area.

$$y = 36.2 + 0.09x \quad (2)$$

The present studies resulted in the inferences that the trend lines from 2, 3 and 5-days antecedent rainfall (fig 2-4) all have the intercept values in the range of 16.1 – 36.2 mm. This indicates that in the absence of antecedent rainfall, a daily rainfall *i.e.* approximately ≥ 16 mm could trigger a landslide in Aizawl area. The positive coefficient of the antecedent rainfall, in all the three equations (fig 2-4) indicates that an increase in cumulative antecedent rainfall results in an increase amount of daily rainfall required to trigger landslide. During the selected

270 days, the daily rainfall was observed to surpass the threshold 67 times, of which thirteen resulted in landslides. The probability of a landslide is observed to be 19% (13/67).

Table 1: Daily and Antecedent rainfall for Aizawl district (Source – State Meteorological Centre, Directorate of Science & Technology, Government of Mizoram)

Date	Daily Rainfall (mm)	Antecedent Rainfall - 2 days	Antecedent Rainfall - 3 days	Antecedent Rainfall - 5 days
15-05-2019	3.5	16.50	13.00	13.00
16-05-2019	25.0	20.00	20.00	13.00
17-05-2019	4.5	28.50	45.00	13.00
18-05-2019	19.7	29.50	33.00	49.50
19-05-2019	9.2	24.20	49.20	69.20
20-05-2019	0.0	28.90	33.40	61.90
21-05-2019	0.0	9.20	28.90	58.40
22-05-2019	0.0	0.00	9.20	33.40
23-05-2019	0.0	0.00	0.00	28.90
24-05-2019	65.0	0.00	0.00	9.20
25-05-2019	23.0	65.00	65.00	65.00
26-05-2019	0.3	88.00	88.00	88.00
27-05-2019	0.0	23.30	88.30	88.30
31-05-2019	0.0	0.30	23.30	88.30
01-06-2019	0.0	0.00	0.30	88.30
02-06-2019	0.0	0.00	0.00	23.30
03-06-2019	2.0	0.00	0.00	0.30
04-06-2019	0.0	2.00	2.00	2.00
05-06-2019	21.0	2.00	2.00	2.00
06-06-2019	0.0	21.00	23.00	23.00
07-06-2019	25.0	21.00	21.00	23.00
22-06-2019	6.0	5.00	5.00	30.00
23-06-2019	3.0	11.00	11.00	36.00
24-06-2019	0.0	9.00	14.00	14.00
25-06-2019	0.0	3.00	9.00	14.00
26-06-2019	0.0	0.00	3.00	14.00
27-06-2019	1.0	0.00	0.00	9.00
28-06-2019	2.0	1.00	1.00	4.00
29-06-2019	0.0	3.00	3.00	3.00
30-06-2019	10.0	2.00	3.00	3.00
01-07-2019	14.0	10.00	12.00	13.00
02-07-2019	6.0	24.00	24.00	27.00
03-07-2019	26.0	20.00	30.00	32.00
04-07-2019	0.0	32.00	46.00	56.00
05-07-2019	0.0	26.00	32.00	56.00
06-07-2019	3.0	0.00	26.00	46.00
07-07-2019	4.0	3.00	3.00	35.00
08-07-2019	26.0	7.00	7.00	33.00

09-07-2019	26.0	30.00	33.00	33.00
10-07-2019	30.0	52.00	56.00	59.00
11-07-2019	73.0	56.00	82.00	89.00
12-07-2019	51.0	103.00	129.00	159.00
13-07-2019	41.0	124.00	154.00	206.00
14-07-2019	40.0	92.00	165.00	221.00
15-07-2019	9.0	81.00	132.00	235.00
16-07-2019	7.0	49.00	90.00	214.00
17-07-2019	32.0	16.00	56.00	148.00
18-07-2019	55.0	39.00	48.00	129.00
19-07-2019	20.0	87.00	94.00	143.00
20-07-2019	1.0	75.00	107.00	123.00
21-07-2019	8.0	21.00	76.00	115.00
22-07-2019	0.0	9.00	29.00	116.00
23-07-2019	0.0	8.00	9.00	84.00
24-07-2019	5.0	0.00	8.00	29.00
25-07-2019	10.0	5.00	5.00	14.00
26-07-2019	30.0	15.00	15.00	23.00
27-07-2019	2.0	40.00	45.00	45.00
28-07-2019	10.0	32.00	42.00	47.00
29-07-2019	3.0	12.00	42.00	57.00
30-07-2019	2.0	13.00	15.00	55.00
31-07-2019	5.0	5.00	15.00	47.00
01-08-2019	0.0	7.00	10.00	22.00
02-08-2019	0.0	5.00	7.00	20.00
03-08-2019	30.0	0.00	5.00	10.00
04-08-2019	25.0	30.00	30.00	37.00
05-08-2019	0.0	55.00	55.00	60.00
06-08-2019	0.0	25.00	55.00	55.00
07-08-2019	7.0	0.00	25.00	55.00
08-08-2019	37.0	7.00	7.00	62.00
09-08-2019	0.0	44.00	44.00	69.00
01-01-2020	1.7	37.00	44.00	44.00
02-01-2020	0.0	1.70	38.70	45.70
03-01-2020	45.0	1.70	1.70	45.70
04-01-2020	0.0	45.00	46.70	83.70
04-04-2020	0.0	5.70	5.70	5.70
05-04-2020	1.5	3.00	5.70	5.70
06-04-2020	0.0	1.50	4.50	7.20
07-04-2020	0.0	1.50	1.50	7.20
08-04-2020	0.0	0.00	1.50	4.50
09-04-2020	0.0	0.00	0.00	1.50
10-04-2020	0.0	0.00	0.00	1.50
11-04-2020	0.0	0.00	0.00	0.00
12-04-2020	0.0	0.00	0.00	0.00
13-04-2020	0.0	0.00	0.00	0.00
14-04-2020	0.0	0.00	0.00	0.00
15-04-2020	0.0	0.00	0.00	0.00

16-04-2020	29.0	0.00	0.00	0.00
17-04-2020	0.0	29.00	29.00	29.00
18-04-2020	27.0	29.00	29.00	29.00
19-04-2020	2.5	27.00	56.00	56.00
20-04-2020	0.0	29.50	29.50	58.50
21-04-2020	0.0	2.50	29.50	58.50
22-04-2020	0.0	0.00	2.50	29.50
23-04-2020	5.3	0.00	0.00	29.50
24-04-2020	9.0	5.30	5.30	7.80
25-04-2020	1.0	14.30	14.30	14.30
26-04-2020	14.5	10.00	15.30	15.30
27-04-2020	0.0	15.50	24.50	29.80
28-04-2020	12.5	14.50	15.50	29.80
29-04-2020	0.0	12.50	27.00	37.00
30-04-2020	0.3	12.50	12.50	28.00
01-05-2020	0.0	0.30	12.80	27.30
02-05-2020	36.2	0.30	0.30	12.80
03-05-2020	0.5	36.20	36.50	49.00
04-05-2020	0.0	36.70	36.70	37.00
05-05-2020	35.5	0.50	36.70	37.00
06-05-2020	10.3	35.50	36.00	72.20
07-05-2020	0.0	45.80	45.80	82.50
05-06-2020	0.0	22.30	22.30	31.30
06-06-2020	4.6	10.30	22.30	22.30
07-06-2020	0.0	4.60	14.90	26.90
08-06-2020	0.0	4.60	4.60	26.90
09-06-2020	28.0	0.00	4.60	14.90
10-06-2020	54.0	28.00	28.00	32.60
11-06-2020	10.0	82.00	82.00	86.60
12-06-2020	5.5	64.00	92.00	92.00
13-06-2020	7.4	15.50	69.50	97.50
14-06-2020	17.5	12.90	22.90	104.90
15-06-2020	3.0	24.90	30.40	94.40
16-06-2020	6.5	20.50	27.90	43.40
17-06-2020	3.5	9.50	27.00	39.90
18-06-2020	1.5	10.00	13.00	37.90
19-06-2020	0.5	5.00	11.50	32.00
20-06-2020	0.0	2.00	5.50	15.00
21-06-2020	0.0	0.50	2.00	12.00
22-06-2020	0.0	0.00	0.50	5.50
23-06-2020	14.0	0.00	0.00	2.00
24-06-2020	0.2	14.00	14.00	14.50
25-06-2020	0.5	14.20	14.20	14.20
26-06-2020	2.5	0.70	14.70	14.70
27-06-2020	20.5	3.00	3.20	17.20
28-06-2020	12.0	23.00	23.50	37.70
29-06-2020	0.7	32.50	35.00	35.70
30-06-2020	3.6	12.70	33.20	36.20

01-07-2020	4.0	4.30	16.30	39.30
22-08-2020	0.0	36.50	45.50	47.50
23-08-2020	4.0	0.50	36.50	45.50
24-08-2020	3.5	4.00	4.50	49.50
25-08-2020	5.5	7.50	7.50	44.00
26-08-2020	0.5	9.00	13.00	13.50
27-08-2020	0.0	6.00	9.50	13.50
28-08-2020	0.3	0.50	6.00	13.50
29-08-2020	2.7	0.30	0.80	9.80
30-08-2020	0.0	3.00	3.00	9.00
31-08-2020	13.7	2.70	3.00	3.50
01-09-2020	4.0	13.70	16.40	16.70
02-09-2020	34.0	17.70	17.70	20.70
03-09-2020	0.0	38.00	51.70	54.40
04-09-2020	0.0	34.00	38.00	51.70
05-09-2020	0.0	0.00	34.00	51.70
06-09-2020	0.0	0.00	0.00	38.00
07-09-2020	1.0	0.00	0.00	34.00
08-09-2020	0.0	1.00	1.00	1.00
09-09-2020	65.0	1.00	1.00	1.00
10-09-2020	16.0	65.00	66.00	66.00
11-09-2020	0.0	81.00	81.00	82.00
12-09-2020	1.5	16.00	81.00	82.00
13-09-2020	4.5	1.50	17.50	82.50
14-09-2020	1.5	6.00	6.00	87.00
15-09-2020	0.2	6.00	7.50	23.50
16-09-2020	0.2	1.70	6.20	7.70
17-09-2020	5.5	0.40	1.90	7.90
18-09-2020	0.0	5.70	5.90	11.90
19-09-2020	0.0	5.50	5.70	7.40
20-09-2020	1.7	0.00	5.50	5.90
21-09-2020	21.0	1.70	1.70	7.40
22-09-2020	45.0	22.70	22.70	28.20
23-09-2020	15.0	66.00	67.70	67.70
24-09-2020	5.5	60.00	81.00	82.70
25-09-2020	6.5	20.50	65.50	88.20
26-09-2020	4.5	12.00	27.00	93.00
27-09-2020	0.0	11.00	16.50	76.50
28-09-2020	0.0	4.50	11.00	31.50
29-09-2020	0.0	0.00	4.50	16.50
30-09-2020	5.5	0.00	0.00	11.00
01-10-2020	5.5	5.50	5.50	10.00
02-10-2020	30.5	11.00	11.00	11.00
03-10-2020	10.0	36.00	41.50	41.50
04-10-2020	67.5	40.50	46.00	51.50
05-10-2020	37.0	77.50	108.00	119.00
06-10-2020	54.5	104.50	114.50	150.50
07-10-2020	5.5	91.50	159.00	199.50

08-10-2020	0.0	60.00	97.00	174.50
09-10-2020	2.0	5.50	60.00	164.50
10-10-2020	13.0	2.00	7.50	99.00
11-10-2020	12.5	15.00	15.00	75.00
12-10-2020	9.0	25.50	27.50	33.00
13-10-2020	7.0	21.50	34.50	36.50
14-10-2020	0.0	16.00	28.50	43.50
15-10-2020	0.0	7.00	16.00	41.50
16-10-2020	0.0	0.00	7.00	28.50
17-10-2020	5.0	0.00	0.00	16.00
18-10-2020	0.0	5.00	5.00	12.00
19-10-2020	1.0	5.00	5.00	5.00
01-06-2021	20.5	0.70	0.70	1.20
02-06-2021	13.5	21.20	21.20	21.70
03-06-2021	7.0	34.00	34.70	34.70
04-06-2021	2.5	20.50	41.00	41.70
05-06-2021	2.0	9.50	23.00	44.20
06-06-2021	35.5	4.50	11.50	45.50
07-06-2021	3.5	37.50	40.00	60.50
08-06-2021	1.5	39.00	41.00	50.50
09-06-2021	25.5	5.00	40.50	45.00
10-06-2021	20.0	27.00	30.50	68.00
11-06-2021	35.0	45.50	47.00	86.00
12-06-2021	30.0	55.00	80.50	85.50
13-06-2021	35.0	65.00	85.00	112.00
14-06-2021	20.0	65.00	100.00	145.50
15-06-2021	20.5	55.00	85.00	140.00
16-06-2021	30.0	40.50	75.50	140.50
17-06-2021	20.0	50.50	70.50	135.50
18-06-2021	35.0	50.00	70.50	125.50
19-06-2021	20.0	55.00	85.00	125.50
20-06-2021	10.0	55.00	75.00	125.50
21-06-2021	3.5	30.00	65.00	115.00
22-06-2021	2.0	13.50	33.50	88.50
23-06-2021	35.5	5.50	15.50	70.50
23-07-2021	7.5	49.70	99.70	210.20
24-07-2021	4.5	11.00	57.20	152.20
25-07-2021	6.0	12.00	15.50	111.70
26-07-2021	2.5	10.50	18.00	67.70
27-07-2021	35.0	8.50	13.00	24.00
28-07-2021	30.0	37.50	43.50	55.50
29-07-2021	10.0	65.00	67.50	78.00
30-07-2021	2.0	40.00	75.00	83.50
31-07-2021	4.5	12.00	42.00	79.50
01-08-2021	3.4	6.50	16.50	81.50
02-08-2021	4.5	7.90	9.90	49.90
03-08-2021	160.0	7.90	12.40	24.40
04-08-2021	4.0	164.50	167.90	174.40

05-08-2021	35.0	164.00	168.50	176.40
06-08-2021	79.0	39.00	199.00	206.90
07-08-2021	30.0	114.00	118.00	282.50
08-08-2021	56.0	109.00	144.00	308.00
09-08-2021	30.0	86.00	165.00	204.00
10-08-2021	1.5	86.00	116.00	230.00
11-08-2021	0.0	31.50	87.50	196.50
12-08-2021	4.5	1.50	31.50	117.50
13-08-2021	5.0	4.50	6.00	92.00
14-08-2021	8.5	9.50	9.50	41.00
15-08-2021	5.5	13.50	18.00	19.50
16-08-2021	20.0	14.00	19.00	23.50
17-08-2021	19.5	25.50	34.00	43.50
18-08-2021	7.6	39.50	45.00	58.50
19-08-2021	8.4	27.10	47.10	61.10
20-08-2021	6.0	16.00	35.50	61.00
21-08-2021	5.5	14.40	22.00	61.50
22-08-2021	32.0	11.50	19.90	47.00
23-08-2021	9.5	37.50	43.50	59.50
24-08-2021	10.0	41.50	47.00	61.40
25-08-2021	2.4	19.50	51.50	63.00
26-08-2021	0.0	12.40	21.90	59.40
27-08-2021	12.0	2.40	12.40	53.90
28-08-2021	36.0	12.00	14.40	33.90
29-08-2021	17.0	48.00	48.00	60.40
30-08-2021	27.0	53.00	65.00	67.40
31-08-2021	11.0	44.00	80.00	92.00
01-09-2021	42.0	38.00	55.00	103.00
02-09-2021	5.0	53.00	80.00	133.00
03-09-2021	2.0	47.00	58.00	102.00
04-09-2021	10.0	7.00	49	87
05-09-2021	3.0	12.00	17	70
06-09-2021	0.0	13.00	15	62
07-09-2021	5.0	3.00	13	20
08-09-2021	6.5	5.00	8	20
09-09-2021	16.0	11.50	11.5	24.5
10-09-2021	8.0	22.50	27.5	30.5
11-09-2021	0.0	24.00	30.5	35.5
12-09-2021	0.0	8.00	24	35.5
13-09-2021	0.0	0.00	8	30.5

Highlighted are the daily and antecedent rainfall during landslide occurred days.

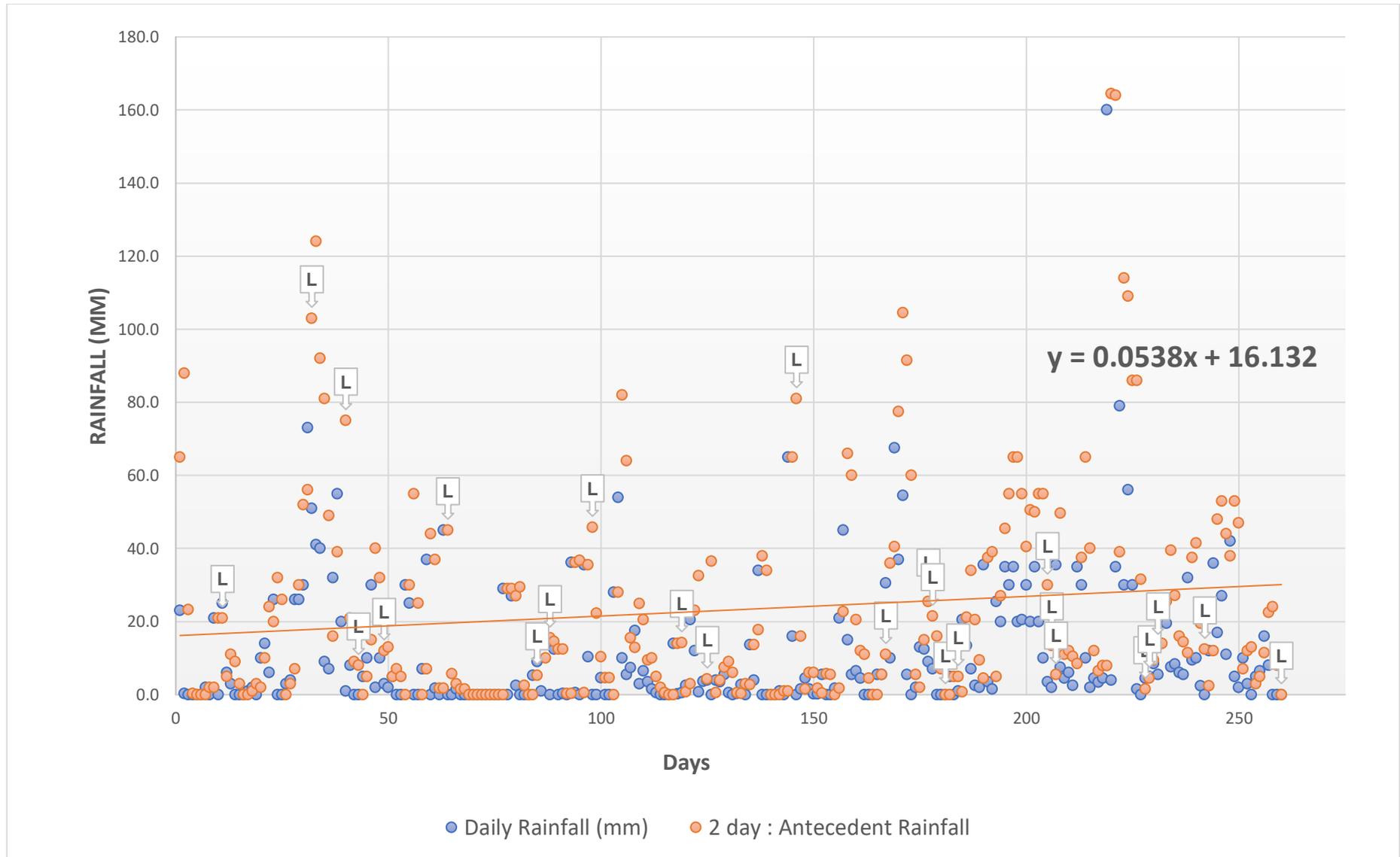


Fig 1. Scatter plot showing 2-day antecedent vs. daily rainfall (L indicates landslide)

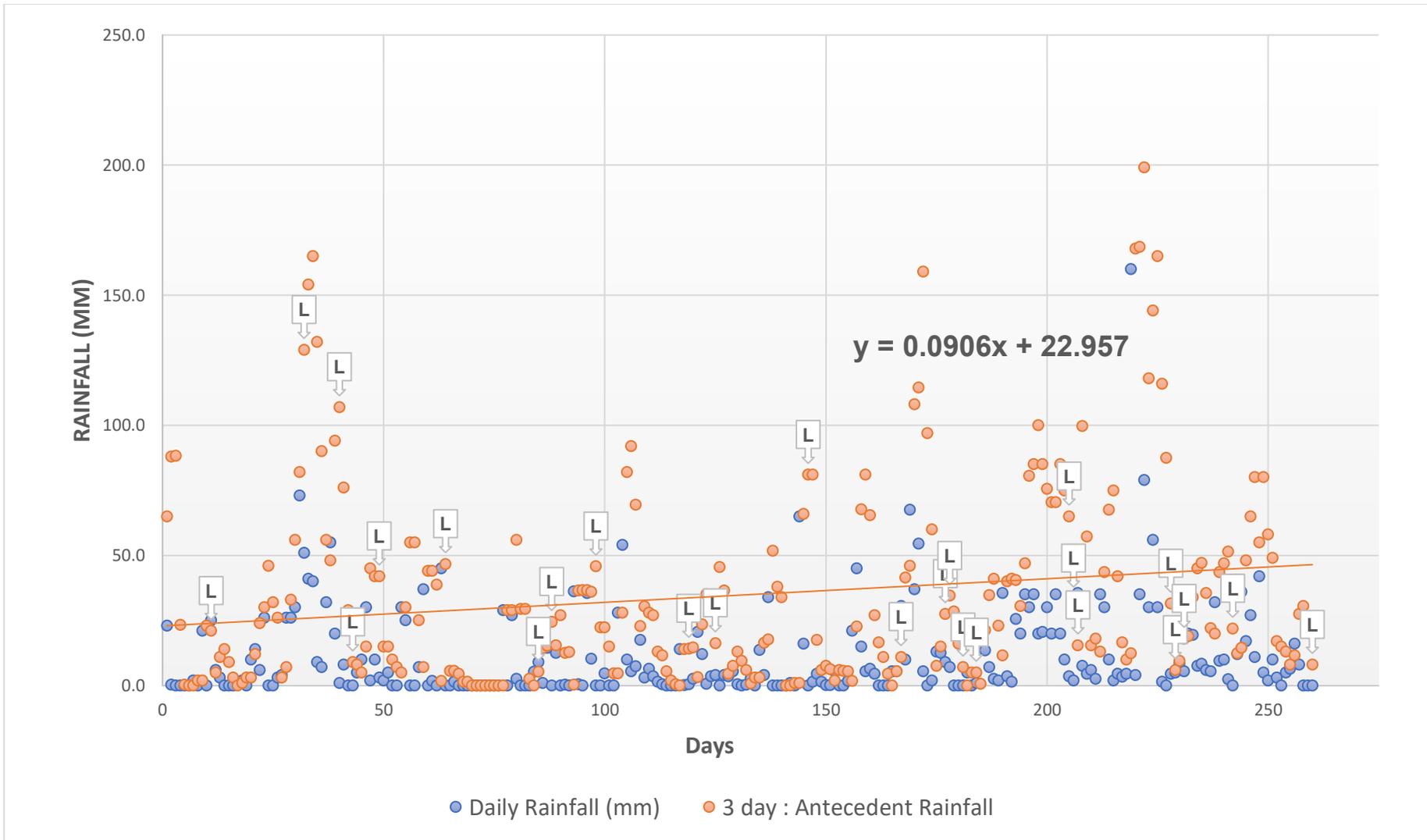


Fig 2. Scatter plot showing 3-day antecedent vs. daily rainfall (L indicates landslide)

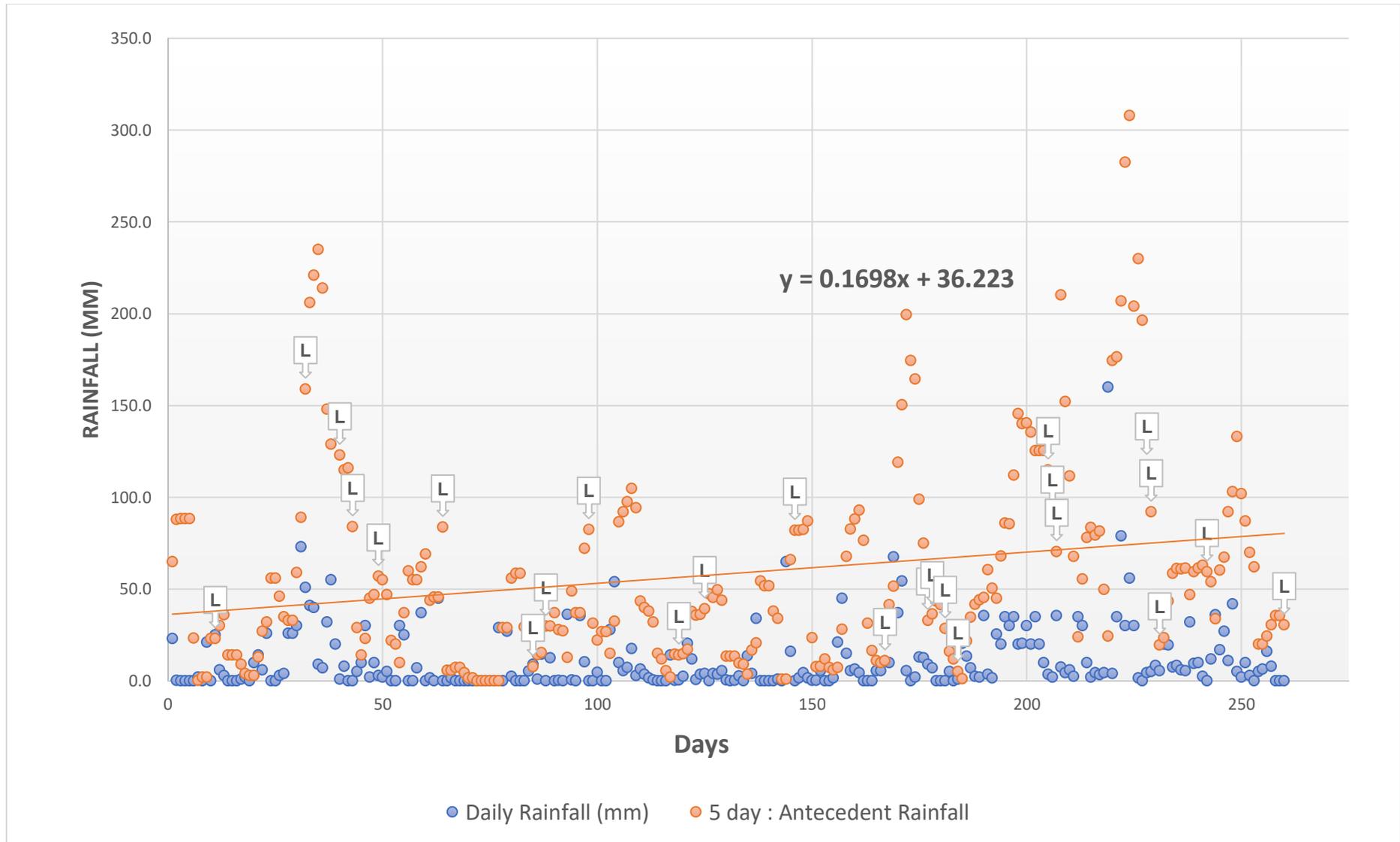


Fig 3. Scatter plot showing 5-day antecedent vs. daily rainfall (L indicates landslide)

ANNEXURE I : List of occurrences of natural hazards in Mizoram (2019)

Date	Type of event	Area	District	Type of damage	Completely destroyed	Partially destroyed	Total	Injury	Death	Remarks
30-01-2019	Fire	Bawngkawn	Aizawl	House	4		4			
06-02-2019	Fire	Zotlang	Champhai	House	5	1	6			
01-04-2019	Wind damage	Different areas	Several	House and buildings			164			
01-04-2019	Wind damage	Thuampui	Aizawl	House and buildings	1	1	2			
01-04-2019	Wind damage	Bilkhawthlir	Kolasib	House and buildings	0	22	22			
01-04-2019	Wind damage	Buhchang	Kolasib	House and buildings	0	6	6			
01-04-2019	Wind damage	Phaisen	Kolasib	House and buildings	0	10	10			
01-04-2019	Wind damage	Bethalmual	Lawngtlai	House and buildings	0	7	7			
01-04-2019	Wind damage	Sangau II	Lawngtlai	House and buildings	0	4	4			
01-04-2019	Wind damage	Saizawh East	Lawngtlai	House and buildings	0	3	3			
01-04-2019	Wind damage	Council Veng, Lawngtlai	Lawngtlai	House and buildings	0	1	1			
01-04-2019	Wind damage	Vartek	Lawngtlai	House and buildings	0	1	1			
01-04-2019	Wind damage	Kawnmawi	Mamit	House and buildings	0	11	11			
01-04-2019	Wind damage	Chhippui	Mamit	House and buildings	0	6	6			
01-04-2019	Wind damage	West Phaileng	Mamit	House and buildings	0	2	2			
01-04-2019	Wind damage	Lunglei Zohnuai	Lunglei	House and buildings			8			

01-04-2019	Wind damage	Lunglei Pukpui	Lunglei	House and buildings			8			
01-04-2019	Wind damage	Lunglei Venghlun	Lunglei	House and buildings			4			
01-04-2019	Wind damage	Lunglei Venglai	Lunglei	House and buildings			3			
01-04-2019	Wind damage	Lunglei Bazar veng	Lunglei	House and buildings			2			
01-04-2019	Wind damage	Lunglei Zotlang	Lunglei	House and buildings			2			
01-04-2019	Wind damage	Lunglei Electric	Lunglei	House and buildings			2			
01-04-2019	Wind damage	Lunglei Ramthar	Lunglei	House and buildings			1			
01-04-2019	Wind damage	Lunglei Zobawk	Lunglei	House and buildings			1			
01-04-2019	Wind damage	Ruallung	Lunglei	House and buildings			15			
01-04-2019	Wind damage	Mautlang	Lunglei	House and buildings			5			
01-04-2019	Wind damage	Vairawkai	Lunglei	House and buildings			4			
01-04-2019	Wind damage	Cherhlun	Lunglei	House and buildings			3			
01-04-2019	Wind damage	Hauruang	Lunglei	House and buildings			1			
01-04-2019	Wind damage	Lungsen	Lunglei	House and buildings			1			
01-04-2019	Wind damage	Niawhtlang I	Siaha	House and buildings			9			
01-04-2019	Wind damage	Noaotla III	Siaha	House and buildings			6			
01-04-2019	Wind damage	Siahatla	Siaha	House and buildings			5			

01-04-2019	Wind damage	Theiva	Siaha	House and buildings			2			
01-04-2019	Wind damage	Siahatla III	Siaha	House and buildings			1			
01-04-2019	Wind damage	Meisatla II	Siaha	House and buildings			1			
01-04-2019	Wind damage	Keitum	Serchhip	House and buildings			2			
01-04-2019	Wind damage	Khumtung	Serchhip	House and buildings			1			
01-04-2019	Wind damage	Thenzawl	Serchhip	House and buildings			1			
02-04-2019	Hail damage	Chamring	Aizawl	House and buildings	5	10	15			
02-04-2019	Wind damage	Tlungvel	Aizawl	House and buildings, electric poles			1			Chief house
15-04-2019	Wind damage	Vairengte	Kolasib	House and buildings	6	14	20			
15-04-2019	Wind damage	Saipum	Kolasib	House and buildings	4	8	12			
15-04-2019	Wind damage	Saihapui-V	Kolasib	House and buildings			Several			Power supply disrupted
15-04-2019	Wind damage	Vairengte chhehvel	Kolasib	Electric poles and trees			Several			Power supply disrupted
04-05-2019	Fire	Champhai	Champhai	House		1	1			
04-05-2019	Fire	Keifang	Saitual	House		1	1			
04-05-2019	Fire	Tlamsam	Champhai	House		1	1			
08-05-2019	Fire	Serchhip Zozam veng	Serchhip	Medical quarter building, Injury		1	1	5		
09-05-2019	Fire	Khawhnai	Mamit	House		1	1			
23-05-2019	Landslide	Saihapui K	Kolasib	House, injury and death			1	2	1	
25-05-2019	Rock fall	Aizawl Ngaizel	Aizawl	Scooter	1		1			

27-05-2019	Earth crack	Saihapui	Mamit	House	12		12			
10-06-2019	Landslide	Serchhip	Serchhip	House	2		2			
02-07-2019	Landslide	Durtlang BSUP	Aizawl	House			Several	11	3	
10-07-2019	Landslide	Ramhlun Sport Complex	Aizawl	Roadblock						1 bike damaged
10-07-2019	Landslide	Dinthar leh Tuikual Inrina	Aizawl	Roadblock						
11-07-2019	Landslide	Serchhip	Serchhip	House	1		1			
11-07-2019	Landslide	Phairuangkai	Serchhip	House			1	2		
11-07-2019	Earth crack	Bunghmun	Lunglei	Church			1			
11-07-2019	Landslide	Kanghmun	Mamit	House			1			
12-07-2019	Landslide	Serchhip	Serchhip	House			3			
13-07-2019	Landslide	Sihphirtlang	Lunglei	Roadblock			Several			1 week
13-07-2019	Landslide	Hnahthial	Hnahthial	House	5		5			
13-07-2019	Landslide	Lunglei College Veng	Lunglei	House	12		12			
13-07-2019	Flood	Tlabung	Lunglei	House			150			
13-07-2019	Flood	Tipperighat	Lunglei	House			130			
13-07-2019	Flood	Tablabagh	Lunglei	House			80			
13-07-2019	Flood	Sumasumi	Lunglei	House			12			
13-07-2019	Flood	Belkhai	Lunglei	House			Several			
13-07-2019	Landslide	Serchhip	Serchhip	House			7			
13-07-2019	Landslide	Serchhip	Serchhip	Roadblock						
13-07-2019	Landslide	Bawngkawn	Aizawl	House			2+			
13-07-2019	Landslide	Hnahthial	Hnahthial	House		2	2			
13-07-2019	Flood	Ngengpuikai	Lawngtlai	House			Several			
13-07-2019	Earth crack	Darlung	Mamit	House			1			
13-07-2019	Earth crack	Kanghmun	Mamit	House			1			
13-07-2019	Earth crack	Thakthing veng	Aizawl	House			2			
13-07-2019	Earth crack	Lunglei tourist lodge	Lunglei	Roadblock						
19-07-2019	Landslide	Mualkhang	Aizawl	Roadblock						5 days
19-07-2019	Landslide	Khawzawl	Khawzawl	Roadblock						2 day

20-07-2019	Landslide	Kawlkulh	Khawzawl	Roadblock						1 day
25-07-2019	Landslide	Bawngkawn	Aizawl	Roadblock						3 days
03-08-2019	Flood	Bairabi	Kolasib	House			1			
03-08-2019	Landslide	Bairabi	Kolasib	House			2			
03-08-2019	Landslide	Darlawn	Aizawl	House	1		1			
04-08-2019	Landslide	Thingdawl	Kolasib	House	1		1			
09-08-2019	Landslide	Ruantlang	Champhai							
09-08-2019	Landslide	Champhai Kanan	Champhai							
14-08-2019	Landslide	Fungkah	Lawngtlai							Started form 1990, massive slide during 1995-96
13-11-2019	Earth crack	Vaivakawn	Aizawl	House		3	3			
21-11-2019	Landslide	Hunthar veng	Aizawl	Road damage						
31-12-2019	Fire		Mamit				142			

ANNEXURE II : List of occurrences of natural hazards in Mizoram (2020)

Date	Type of event	Area	District	Type of damage	Completely destroyed	partially destroyed	Total	Injury	Death	Remarks
19-01-2020	Fire	Khawzawl Vengthar	Khawzawl	House	1		1			
02-02-2020	Landslide	Zemabawk	Aizawl	House and Roadblock	1		1			
05-02-2020	Fire	Meidum	Kolasib	House	2		2			
03-03-2020	Fire	CTI Sesawng	Aizawl	House	3		3			
07-03-2020	Landslide	Leite leh Maudarh inkar	Hnahthial/Lunglei	Death					2	
10-04-2020	Hailstorm	Pangzawl	Hnahthial/Lunglei	House		75	75			
14-04-2020	Landslide	Darlawn	Aizawl	House						

17-04-2020	Rock fall	Ngaizel	Aizawl	Roadblock, restaurant, ATM booth and vehicles		4	4			
18-04-2020	Wind damage	Tuirial	Aizawl	Powerline		1	1			
01-05-2020	Hailstorm and wind	58 village	Mizoram	House			788			268 houses in Hliappui village
11-05-2020	Landslide	Buarpui	Lunglei							
13-05-2020	Hailstorm	Rengdil	Mamit	House		91	211			
13-05-2020	Hailstorm	Zamuang	Mamit	House		82	216			
13-05-2020	Hailstorm	Damdai	Mamit	House		4	27			
27-05-2020	Earth crack	Vaivakawn	Aizawl	Shop buildings						
27-05-2020	Wind damage	Suangpuilawn	Aizawl	Sparrow death					140	
27-05-2020	Wind damage	Zuangtui	Aizawl	House and injury	1	8		4		
12-06-2020	Landslide	Dapchhuah	Mamit	Roadblock and vehicle			1			
15-06-2020	Landslide	Bawngkawn	Aizawl	Roadblock						
21-06-2020	Landslide	Bawngkawn	Aizawl	Roadblock						
19-07-2020	Landslide	South Lungpher	Siaha	Roadblock						3 days
25-07-2020	Landslide	Vaphai	Champhai	House	3		3			
01-09-2020	Landslide	Bawngkawn	Aizawl	Death					1	
22-09-2020	Landslide	Bawngkawn	Aizawl	Roadblock						
02-10-2020	Flood	Tiau	Champhai	Rice field and tractors						Some rice fields and two tractors
02-10-2020	Landslide	Rulchawm	Saitual	Roadblock and houses						Several houses
03-10-2020	Landslide	Phullen	Saitual	Roadblock and house			3			
06-10-2020	Landslide	Zemabawk	Aizawl	3 Houses and 2 Vehicles	3	2	5			
09-10-2019	Landslide	Sairang	Aizawl	Roadblock						
12-10-2020	Landslide	Hnahthial	Hnahthial	Road damage						
21-10-2020	Landslide	Khawzawl	Khawzawl	House	5		5			
29-10-2020	Fire	Selesih	Aizawl	House, injury, and death		1	1	3	1	

ANNEXURE III : List of occurrences of natural hazards in Mizoram (2021)

Date	Type of event	Area	District	Type of damage	Completely destroyed	partially destroyed	Total	Injury	Death	Remarks
25/02/2021	Forest Fire	Kepran	Aizawl	Death					1	
06/03/2021	Fire	Khawhnai	Mamit	House and pig death	7		7		1	
06/03/2021	Fire	Thingdawl	Kolasib	House	1		1			
07/03/2021	Fire	Ruallung	Saitual	House and death	1		1		1	
11/03/2021	Forest Fire	Ngaizawl	??	Death			1			
13/03/2021	Fire	Maubawk	Aizawl	House and domestic animal death	15		15		21	
24/03/2021	Forest Fire	Reiek	Mamit							3 days
27/03/2021	Fire	T Dumzau	Lawngtlai	House	25		25			
29/03/2021	Fire	Serchhip dinthar	Serchhip	House	4		4			
15/04/2021	Fire	Reiek kai	Aizawl	House and death	1		1		1	
20/04/2021	Forest Fire	Thinglian	Lunglei							
24/04/2021	Forest Fire	Saisih, Venglai, Chanmari	Lunglei							
25/04/2021	Forest Fire	Bungtlang South	Lawngtlai	House	12		12			
25/04/2021	Forest Fire	S Vanlaiphai	Hnahthial							
25/04/2021	Forest Fire	Mampui	Lawngtlai							
25/04/2021	Forest Fire	Ngengpui Thingkah	Lawngtlai							
25/04/2021	Forest Fire	Saizawh	Lawngtlai							
25/04/2021	Forest Fire	Lawngtlai range	Lawngtlai							
25/04/2021	Forest Fire	Cheural	Siaha							
25/04/2021	Forest Fire	North Vanlaiphai	Serchhip							
26/04/2021	Forest Fire	Darzo	Lunglei							
28/04/2021	Forest Fire	Phawngpui tlang	Lawngtlai							
31/05/2021	Fire	Sakawrtuichhun	Aizawl	Camping centre room	1		1			
05/06/2021	Fire	Chawngte	Lawngtlai	Shop buildings	2		2			
08/06/2021	Landslide	Pangzawl	Hnahthial	Roadblock						

11/06/2021	Landslide	Thuampui	Aizawl	House and death	1		1		4	
12/06/2021	Landslide	Bawngkawn	Aizawl							
13/06/2021	Landslide	Ngaizel	Aizawl	Roadblock						
15/06/2021	Earth crack	Pangzawl	Hnahthial	Road						
05/07/2021	Fire	Bilkhawthlir	Kolasib	House	1		1			Total road damage
03/08/2021	Landslide	Khawruhlian	Aizawl	Road damage						
02/08/2021	Landslide	Bawngkawn	Aizawl	Car	1		1			5 houses abandoned
05/08/2021	Landslide	Tlangnuam	Aizawl	Roadblock						Partial
05/08/2021	Landslide	New Capital Complex	Aizawl	Roadblock						Partial
16/08/2021	Rockslide	Ngaizel	Aizawl	Roadblock						
23/08/2021	Landslide	Champhai-Zokhawthar road	Champhai	whole road slide away						
03/09/2021	Landslide	Zemabawk	Aizawl	Electric post, car and scooty damaged						

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