Natural Hazards
and Earth System
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EGU

Supplement of

Characteristics of debris-flow-prone watersheds and debris-flow-triggering rainstorms following the Tadpole Fire, New Mexico, USA

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This supporting information file contains 3 tables and 3 figures.

Sample Type	Latitude	Longitude	Sand (%)	Silt (%)	Clay (%)
Hillslope (0-5cm)	32.95856	-108.23450	46.3	43.1	10.6
Hillslope (0-5cm)	32.95583	-108.23230	39.6	46.1	14.3
Debris Flow	32.95552	-108.23255	76.0	18.4	5.6
Debris Flow	32.95809	-108.24071	80.7	11.7	7.6
Debris Flow	32.95784	-108.23170	63.7	22.6	13.7
Debris Flow	32.95838	-108.23131	82.2	10.6	7.2
Debris Flow	32.95809	-108.24071	61.2	25.4	13.4
Debris Flow	32.96103	-108.23588	58.5	26.8	14.7

Table S1: Percentages of sand, silt, and clay were determined using the hydrometer method for hillslope samples, taken at a depth of 0-5 cm, and samples of debris flow deposits.

Watershed ID	Date	Flow Timing (UTC)	Storm Start (UTC)	Storm End (UTC)	I_{15}^* (mm/h)	I_{15}^p (mm/h)	I_{30}^* (mm/h)	I_{30}^p (mm/h)	R_{tot}^* (mm)	R_{tot} (mm)
B	18 July 20200	22:38	22:12	22:56	53	53	33	36	16	20
C	18 July 2020	22:38	22:12	22:56	53	53	33	36	16	20
D	18 July 2020	22:33	22:12	22:56	51	53	28	36	14	20
E	21 July 2020	20:59	20:38	21:23	52	52	31	31	15	16
E	21 July 2020	21:04	20:38	21:23	52	52	31	31	15	16
A	24 July 2020	10:42	10:34	10:51	33	34	16	18	8	9
C	9 Sept. 2020	5:17	4:57	5:55	55	93	31	72	15	45
D	9 Sept. 2020	5:16	4:57	5:55	50	93	28	72	14	45
A	9 Sept. 2020	5:21	4:55	6:13	76	86	47	66	23	44

Table S2: Summary of debris flow timing information and triggering rainfall characteristics, including triggering 15 (I_{15}^*) and 30-minute rainfall intensities (I_{30}^*), peak 15 (I_{15}^p) and 30-minute rainfall intensities (I_{30}^p), cumulative rainfall prior to debris flow initiation (R_{tot}^*), and storm cumulative rainfall (R_{tot}).

Watershed ID	dNBR	MH23	KF
1	549	0.78	0.2
2	464	0.92	0.2
3	401	0.26	0.2
4	579	0.78	0.2
5	716	0.85	0.2
6	648	0.64	0.2
A	715	0.74	0.2
B	611	0.62	0.2
C	637	0.64	0.2
D	723	0.68	0.2
7	364	0.12	0.2
E	395	0.45	0.2
8	211	0.15	0.2
9	198	0	0.2
10	176	0.07	0.2
11	164	0	0.2
12	145	0.06	0.2

Table S3: Burn severity, terrain, and soil attributes needed for input to the M1 debris flow likelihood model, specifically watershed average differenced normalized burn ratio (dNBR), the fraction of watershed area greater than 23 degrees that burned at moderate or high severity (MH23), and the watershed average soil KF factor.
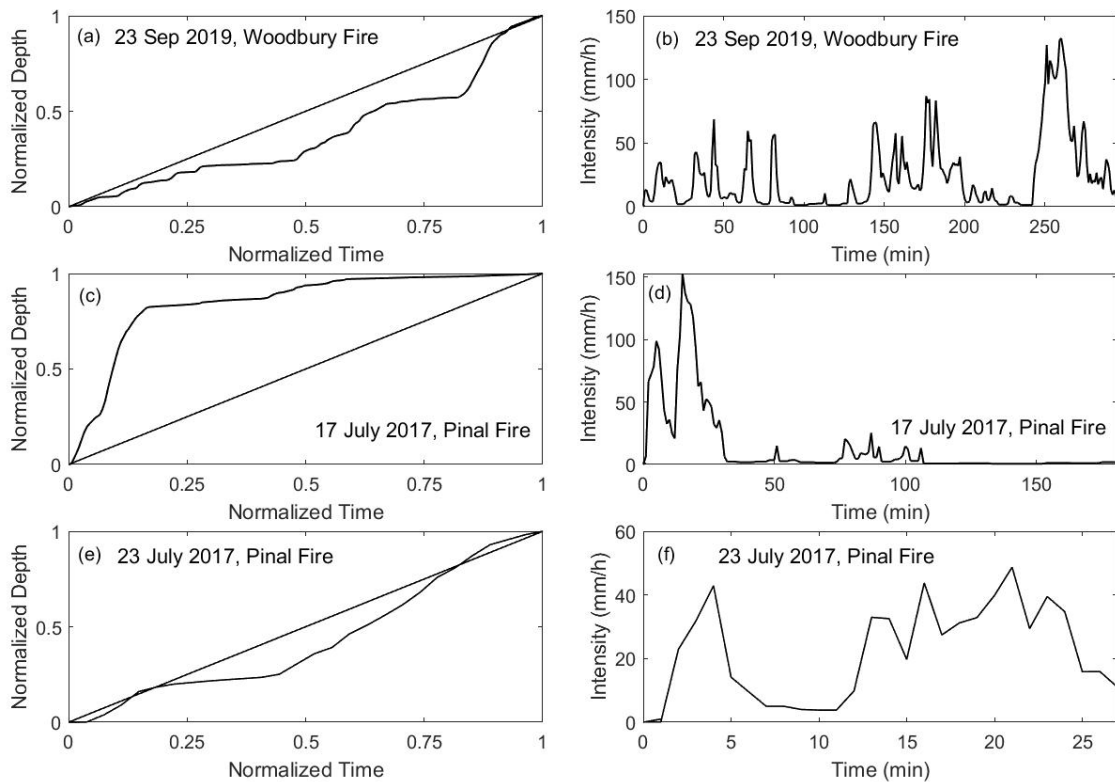
Figure S1: Standardized rainfall profiles (SRPs) provide a way to visually assess the temporal variability of rainfall within storms. (a) SRP for a rainstorm that produced debris flows following the 2019 Woodbury Fire (McGuire et al., 2021). Rainfall data are from the B2 rain gage in McGuire et al. (2021). We classify rainstorms based on the quartile of storm duration that contains the highest cumulative rainfall total. That is, if the majority of rainfall occurs during the first quartile of the storm it is classified as a Q1 storm, storms with a majority of rainfall during the 2nd, 3rd, or 4th quartile of the storm duration are classified as Q2, Q3, and Q4 storms, respectively (Huff, 1967). In this Q4 rainstorm, more rainfall occurred during the fourth quartile of the storm duration compared with any other quartile. (b) SRP of a Q1 rainstorm that produced a debris flow following the 2017 Pinal Fire (Raymond et al., 2020). Rainfall data are from the 651 South rain gauge in Raymond et al. (2020). (c) SRP of a Q3 rainstorm that produced a flood flow following the 2017 Pinal Fire (Raymond et al., 2020). Rainfall data are from the 651 South rain gauge in Raymond et al. (2020).

Figure S2: Pebble counts provide a method to quantify the grain size distribution of the coarse fraction of debris flow deposits. This photograph of a pebble count in progress was taken following the 2022 Pipeline Fire in northern Arizona, USA.
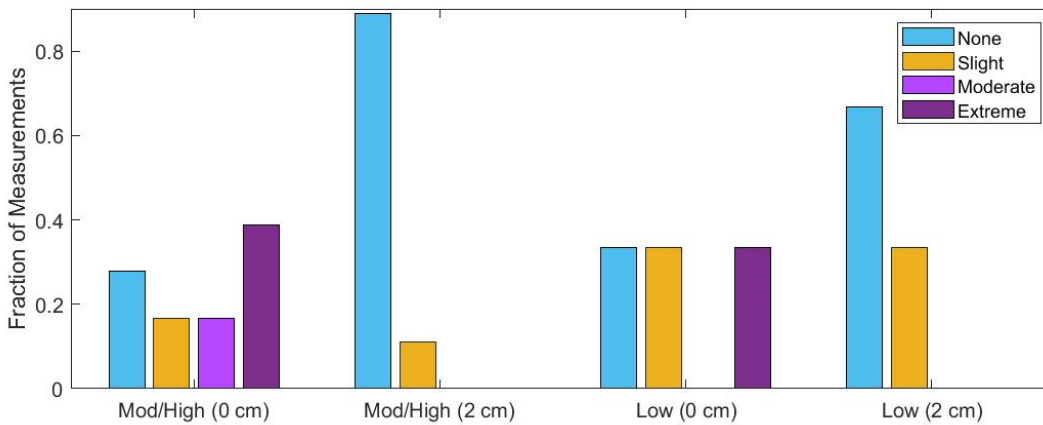

Figure S3: Soil water repellency measurements made in July 2020 using the water drop penetration time test demonstrate greater water repellency at the soil surface (0 cm) compared that found at 2 cm depth. Classification of soil water repellency is determined by the time to absorption with 0-5 s, 5-60 s, 60-180 s, and 180+ seconds indicating no, slight, moderate, and extreme water repellency.
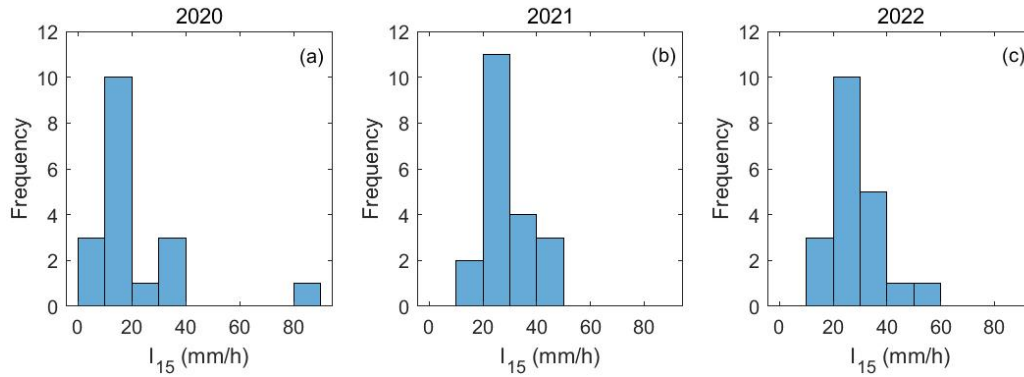
Figure S4: Histograms showing the frequency of peak I_{15} for the 20 most intense rainstorms during each year of monitoring.

References

Huff FA. 1967. Time distribution of rainfall in heavy storms. Water Resources Research **3** : 1007–1019. DOI: 10.1029/WR003i004p01007

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Raymond CA, McGuire LA, Youberg AM, Staley DM, Kean JW. 2020. Thresholds for post-wildfire debris flows: Insights from the Pinal Fire, Arizona, USA. Earth Surface Processes and Landforms **45** : 1349–1360. DOI: 10.1002/esp.4805