EARTHQUAKE ACTIVITY IN THE YELLOWSTONE REGION

Preliminary Epicenters

July 1 – September 30, 2019

Prepared by the University of Utah Seismograph Stations and funded by
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December 17, 2019

Foreword and Data Explanation

This report contains an epicenter map (Figure 1) and listings of earthquakes (Tables 1 and 2) detected and located in the Yellowstone region (lat. 44° 00′ – 45° 10′ N, long. 109° 45′ – 111° 30′ W). The computer program HYPOINVERSE-2000 (F. W. Klein, 2012, U.S. Geological Survey Open-File Report 02-171 revised) was used to process the earthquake data. This report also includes maps and a table of operating seismograph stations in the University of Utah's Yellowstone seismic network (Figure 2, Table 3).

The earthquake listing in Table 2 is estimated to be systematically complete above magnitude 1.5 within Yellowstone. *These data are preliminary—both the locations and magnitudes in this table are subject to revision.*

The following data are listed for each earthquake in Table 2:

- Date (yymmdd) and origin time in Coordinated Universal Time (UTC). To convert to local time, subtract seven hours for Mountain Standard Time (MST) and six hours for Mountain Daylight Time (MDT). During the report period, local time was MDT.

- Earthquake location coordinates in degrees and minutes of north latitude and west longitude, and depth in kilometers below sea level. Note that prior to October 1, 2012, the earthquake depths in these quarterly reports were computed relative to a datum of 2000 m above sea level.

- "*" indicates poor depth resolution: no recording stations within 10 km or twice the depth.

- MAG, the computed Richter local magnitude (M_L) for each earthquake. "W" indicates that peak amplitude measurements from Wood-Anderson records were used. Otherwise, the estimate is calculated from signal durations and is more correctly identified as coda magnitude (M_C). The notation "--" indicates that a reliable magnitude estimate could not be made.

- NO, the number of P and S readings used in the solution.

- GAP, the largest azimuthal separation in degrees between recording stations used in the solution.

- DMN, the epicentral distance in kilometers to the closest station.

- RMS, the weighted root-mean-square of the travel-time residuals in seconds:

$$RMS = \left(\frac{\sum_i (W_i R_i)^2}{\sum_i (W_i)^2} \right)^{\frac{1}{2}}$$

where: R_i is the observed minus the computed arrival time for the i-th P or S reading, and W_i is the relative weight given to the i-th P or S arrival time (0.0 for no weight through 1.0 for full weight).

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July 1 – September 30, 2019

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During the three-month period July 1 through September 30, 2019, the University of Utah Seismograph Stations (UUSS) located 333 earthquakes within the Yellowstone region (Figure 1). The total includes one earthquake in the magnitude 3 range and 23 earthquakes in the magnitude 2 range. The largest event to occur during this period was a magnitude 3.5 earthquake on August 15th. There were no earthquakes reported felt in the region during the report period (see Table 1, a cumulative tabulation of earthquakes that were felt in the Yellowstone region during 2019). Additional information on earthquakes within the Yellowstone region is available from the University of Utah Seismograph Stations.

Online Information

A complete copy of this report, including maps and the earthquake catalog, is available on the UUSS web site at *https://quake.utah.edu/earthquake-center/quarterly-seismicity-reports*.

Note: On October 1, 2012, UUSS began using the ANSS Quake Monitoring System (AQMS) software package for data acquisition and data processing. The primary effect on the data reported herein comes from computing the earthquake locations with a newer version of the computer program HYPOINVERSE-2000 (F. W. Klein, 2012, U.S. Geological Survey Open-File Report 02-171 revised) and a revised and expanded set of velocity models. As implemented at UUSS, this new version of the location program accounts for station elevation differences more accurately and reports focal depths relative to sea level instead of the 2000 m elevation datum used previously.

For earthquakes of magnitude 3 and larger in the Yellowstone region, the U. S. Geological Survey automatically posts a Community Internet Intensity Map (CIIM) on its "Did You Feel It?" web page at http://earthquake.usgs.gov/earthquakes/dyfi/. We encourage anyone who feels an earthquake to report their observations on this interactive web site; felt information is available by zip code on the CIIM site or can be obtained from UUSS directly.

Earthquakes of Magnitude 3.0 or Larger

M_L 3.5	August 15	01:46 MDT	22.0 mi SE of West Thumb, YNP

Notable Swarm Seismicity

During the report period, there were four earthquake swarms in the Yellowstone region. For reporting purposes, we use the Mogi definition [Mogi, 1963] of a swarm and require each swarm to have ten or more earthquakes. Note that typically, around 50% of Yellowstone earthquakes occur as part of a seismic swarm [Farrell et al., 2009].

A. A swarm of 17 earthquakes ($0.0 \leq M \leq 2.3$) occurred about 4.8 mi SSE of Norris Geyser Basin, YNP from July 2nd – 7th.
B. A swarm of 16 earthquakes ($0.3 \leq M \leq 2.1$) occurred about 9.0 mi NNE of Old Faithful, YNP on July 19th.
C. A swarm of 61 earthquakes ($0.0 \leq M \leq 2.9$) occurred about 9.2 mi NNE of Old Faithful, YNP from July 22nd – 25th.
D. A swarm of 53 earthquakes ($-0.1 \leq M \leq 2.7$) occurred about 5.1 mi SE of West Thumb, YNP from August 29th – September 1st.

These swarms are labeled in Figure 1.

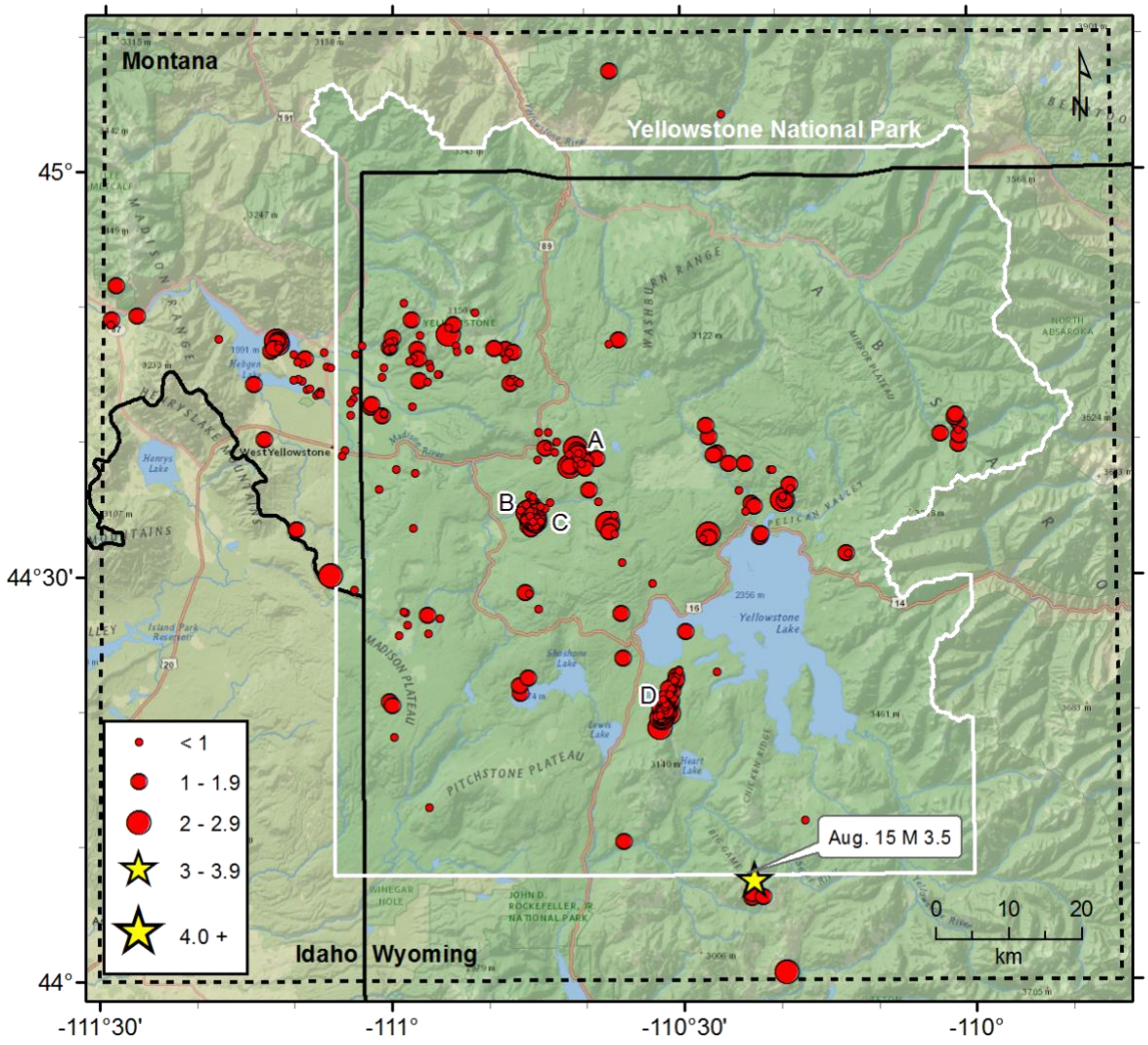

Figure 1. Epicenters of earthquakes located by the University of Utah Seismograph Stations, July 1, 2019, through September 30, 2019. Earthquake swarms (labeled A–D) are discussed in the text.

Table 1

EARTHQUAKES FELT IN THE YELLOWSTONE REGION
January 1, 2019 to September 30, 2019

Date	Time†	Felt Information‡	Latitude	Longitude	Magnitude§
February 16	14:22 MST 21:22 UTC	Yellowstone. Felt (III) at West Yellowstone, MT.	44º 27.90′	111º 00.43′	M_L 3.1

† Times are listed both as Local Time—Mountain Standard Time (MST) or Mountain Daylight Time (MDT)—and as Coordinated Universal Time (UTC).
? Indicates on-line reports that appear questionable given the distance from the source
‡ *CIIM* indicates the availability of a Community Internet Intensity Map (http://earthquake.usgs.gov/earthquakes/dyfi), compiled by the U.S. Geological Survey (USGS); *ShakeMap* indicates the availability of computer-generated maps of ground-shaking (*https://quake.utah.edu*), produced by the University of Utah Seismograph Stations (UUSS). Roman numerals correspond to the Modified Mercalli intensity scale. Unless otherwise indicated, felt information is from the USGS (1) CIIM reports and/or (2) PDE Monthly (or) Weekly Listing Files (http://earthquake.usgs.gov/data/pde.php).
§ Richter local magnitude (M_L) or coda magnitude (M_C) determined by UUSS. If labeled "NEIC," data are from the National Earthquake Information Center of the USGS.

Yellowstone Seismic Network
September 30, 2019

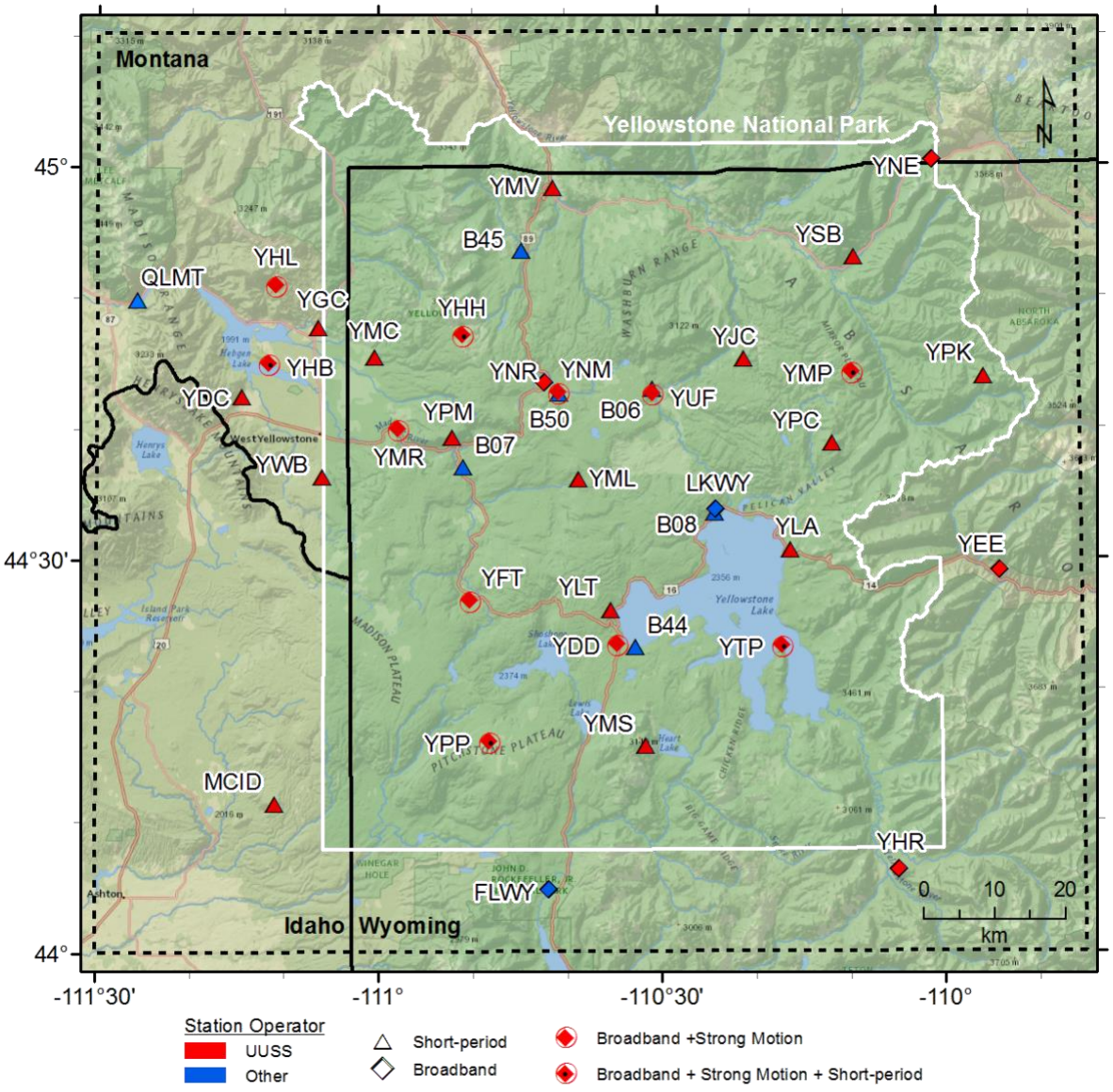

Figure 2. Seismograph stations of the Yellowstone Seismic Network as of September 30, 2019.

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2019

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
190702	06:57:04.11	44º38.39’	110º25.15’	4.5	1.4W	16	116	9	0.14
190702	19:39:50.01	44º39.25’	110º40.38’	7.6	1.6W	16	106	6	0.19
190702	19:40:14.56	44º39.29’	110º43.11’	2.4	0.1	6	193	7	0.13
190703	15:34:55.10	44º38.69’	110º40.43’	5.0	2.0W	15	108	5	0.13
190703	15:35:33.78	44º39.56’	110º40.99’	5.0	2.3	10	118	6	0.15
190703	15:56:09.89	44º38.37’	110º40.37’	5.0	1.4	14	91	4	0.19
190703	15:56:20.01	44º38.09’	110º40.02’	2.1	1.0	7	156	4	0.12
190703	15:56:53.41	44º39.22’	110º40.82’	2.1	1.2	10	106	6	0.23
190703	15:58:07.39	44º38.84’	110º38.78’	5.6	1.8W	13	121	5	0.24
190703	16:00:57.32	44º43.94’	111º03.86’	10.2	0.4	10	120	6	0.19
190703	16:06:17.32	44º43.29’	111º04.07’	9.6	0.4	9	99	6	0.17
190703	16:07:14.35	44º43.02’	111º04.35’	7.8	0.3	8	141	7	0.17
190704	03:16:47.79	44º38.62’	110º39.99’	2.2	1.3W	7	163	5	0.06
190704	10:18:27.99	44º39.48’	110º40.85’	5.0	1.3W	7	151	6	0.14
190704	11:17:50.01	44º47.19’	111º03.15’	11.0	0.8	16	98	4	0.14
190706	05:51:24.45	44º41.23’	110º01.17’	9.4	1.9	10	155	12	0.12
190706	06:08:42.39	44º38.79’	110º40.82’	4.7	0.8	9	147	5	0.08
190706	06:08:52.75	44º39.18’	110º41.68’	4.0	0.2	7	132	7	0.03
190706	06:26:04.34	44º44.55’	110º56.37’	7.8	0.9	10	124	6	0.09
190706	07:42:36.78	44º33.19’	110º21.87’	1.8	1.3	7	195	3	0.06
190706	07:47:45.77	44º32.98’	110º21.95’	1.7	1.7W	12	66	3	0.11
190706	19:40:01.13	44º22.98’	110º26.50’	2.4	0.5	9	191	8	0.08
190707	01:26:31.10	44º40.10’	110º42.92’	3.0	0.7	11	213	6	0.09
190707	01:26:50.45	44º40.80’	110º43.82’	2.0	0.0	6	187	5	0.06
190707	01:26:59.98	44º39.24’	110º40.69’	6.5	0.8	13	102	6	0.09
190707	01:27:54.54	44º38.71’	110º40.62’	5.7	2.1W	17	63	5	0.18
190707	05:09:52.64	44º35.71’	110º19.52’	4.8	2.1W	16	93	7	0.13
190707	16:32:20.97	44º38.48’	110º40.43’	4.3	0.3	13	112	5	0.18
190708	07:23:47.73	44º39.50’	111º04.88’	5.2	0.9	15	72	6	0.18
190709	06:40:57.90	44º46.99’	110º49.39’	4.8	1.5W	20	101	2	0.20
190709	18:57:56.54	44º48.54’	110º54.16’	7.1	0.5	16	130	5	0.19
190713	20:17:13.64	44º35.61’	110º19.33’	7.3	1.5	9	95	10	0.15
190715	07:49:21.81	44º48.77’	110º53.66’	9.4	1.9W	24	50	4	0.15
190715	07:54:56.11	44º48.02’	110º54.22’	9.6	2.4W	27	116	4	0.20
190715	10:48:19.96	44º46.72’	111º07.11’	6.4	0.3	9	84	2	0.16
190715	22:37:10.96	44º47.20’	110º53.42’	5.7	0.8	10	152	3	0.10
190715	22:37:24.45	44º46.93’	110º52.02’	5.2	0.0	8	222	1	0.07
190716	12:56:18.37	44º44.90’	111º01.04’	7.8	0.5	15	83	2	0.14
190718	15:00:58.00	44º49.32’	111º26.60’	11.6	1.1	13	111	1	0.12
190719	15:02:56.82	44º46.92’	110º48.22’	7.1	1.6W	16	183	4	0.17
190719	15:55:17.65	44º35.05’	110º46.70’	8.8	0.9	8	107	7	0.15
190719	15:57:12.44	44º34.48’	110º45.31’	8.3	0.8	8	137	9	0.11
190719	17:46:05.14	44º34.48’	110º45.27’	7.5	0.5	8	138	9	0.10
190719	17:55:44.71	44º34.69’	110º45.22’	7.1	0.8	7	135	9	0.12
190719	17:57:22.03	44º45.08’	110º55.29’	4.8	-0.3	8	123	7	0.07

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2019

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
190719	17:57:29.38	44º45.11’	110º55.14’	6.1	0.6	13	118	7	0.11
190719	19:14:14.01	44º34.76’	110º45.23’	7.0	0.8	8	134	9	0.12
190719	19:14:57.83	44º34.51’	110º45.26’	7.3	1.0	8	137	9	0.12
190719	19:15:39.70	44º34.59’	110º45.47’	8.3	0.9	8	135	9	0.12
190719	19:16:04.91	44º34.38’	110º44.56’	2.8	0.4	8	144	9	0.12
190719	19:31:52.60	44º34.26’	110º45.22’	6.6	1.4	7	99	9	0.12
190719	19:40:53.61	44º34.38’	110º44.95’	5.7	0.3	7	142	9	0.07
190719	19:41:33.14	44º34.94’	110º46.22’	8.1	0.9	7	125	7	0.11
190719	19:44:30.93	44º34.64’	110º45.69’	8.7	0.6	6	132	8	0.09
190719	19:44:48.63	44º34.51’	110º45.31’	7.5	1.5	6	137	9	0.08
190719	19:54:26.45	44º34.88’	110º45.72’	8.6	1.3	7	129	8	0.13
190719	19:54:33.19	44º34.91’	110º45.98’	8.4	2.1	7	127	8	0.18
190719	23:07:03.12	44º34.56’	110º45.84’	7.6	1.9	13	103	8	0.12
190720	04:41:35.44	44º46.56’	111º03.85’	7.6	0.2	10	160	4	0.16
190720	07:25:08.54	44º33.74’	110º57.81’	13.2	0.6	13	91	11	0.12
190722	13:47:05.17	44º34.53’	110º45.49’	6.8	0.7W	6	135	9	0.17
190722	14:35:59.91	44º35.21’	110º45.44’	7.6	1.4W	14	135	8	0.15
190722	14:36:14.78	44º36.17’	110º45.85’	8.0	0.8	13	129	7	0.14
190722	14:40:55.98	44º34.09’	110º45.06’	5.6	1.0W	8	117	10	0.09
190722	14:41:48.31	44º34.47’	110º45.61’	6.6	1.4W	14	74	9	0.14
190722	14:41:48.39	44º35.36’	110º45.45’	6.7	1.4W	14	76	8	0.19
190722	22:49:09.99	44º37.80’	110º57.67’	8.2	0.5	8	147	8	0.12
190723	00:42:34.13	44º46.95’	110º57.46’	4.8	1.7W	15	119	5	0.23
190723	05:57:57.04	44º34.06’	110º44.79’	4.1	0.5	8	147	9	0.09
190723	06:00:06.32	44º34.18’	110º45.52’	7.8	0.6W	14	102	9	0.18
190723	06:40:29.44	44º34.61’	110º45.43’	7.9	2.9W	35	61	9	0.19
190723	06:54:32.93	44º34.61’	110º45.41’	8.6	1.4W	20	72	9	0.17
190723	06:59:28.07	44º34.44’	110º45.23’	7.5	2.1W	24	72	9	0.14
190723	07:10:50.11	44º34.55’	110º45.74’	5.0	0.7	11	103	8	0.23
190723	07:11:12.10	44º34.30’	110º45.00’	2.7	0.8W	14	84	9	0.16
190723	07:14:00.56	44º34.67’	110º45.81’	7.8	0.6W	10	102	8	0.12
190723	07:16:34.51	44º34.10’	110º45.49’	6.1	1.0W	16	87	9	0.12
190723	07:17:48.37	44º34.34’	110º45.72’	5.8	0.5W	16	104	9	0.25
190723	07:31:08.62	44º34.20’	110º45.49’	2.0	0.0	10	102	9	0.22
190723	07:31:23.63	44º34.14’	110º45.47’	4.9	0.7W	12	102	9	0.16
190723	07:31:49.29	44º33.81’	110º45.14’	2.3	0.0	8	148	10	0.10
190723	08:23:57.32	44º34.24’	110º45.09’	5.9	0.8W	14	98	9	0.21
190723	08:25:16.43	44º35.33’	110º44.67’	7.9	0.1	8	129	8	0.28
190723	08:39:24.63	44º34.56’	110º45.24’	7.7	1.2W	19	71	9	0.16
190723	08:39:59.66	44º31.13’	110º36.21’	12.7	0.4	6	264	10	0.33
190723	08:41:57.54	44º34.44’	110º45.52’	7.1	0.8W	11	101	9	0.15
190723	08:42:38.72	44º34.30’	110º45.80’	7.4	0.8W	9	112	9	0.10
190723	08:51:21.32	44º34.10’	110º45.37’	5.7	0.8W	16	86	9	0.13
190723	09:06:10.77	44º34.29’	110º45.63’	6.7	0.7W	9	113	9	0.09
190723	09:29:17.58	44º33.60’	110º45.67’	4.8	1.1W	14	87	10	0.14

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2019

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
190723	09:33:50.92	44º34.34’	110º45.59’	7.6	1.1W	15	87	9	0.13
190723	10:08:26.94	44º34.47’	110º45.65’	8.0	2.4W	25	74	9	0.18
190723	10:35:42.64	44º34.30’	110º45.48’	7.7	1.4W	19	74	9	0.15
190723	10:43:37.11	44º34.46’	110º45.69’	7.7	1.2W	18	74	9	0.15
190723	11:15:30.94	44º34.51’	110º45.59’	8.4	1.1W	16	88	9	0.12
190723	11:15:51.91	44º34.22’	110º44.67’	3.5	0.2	9	145	9	0.13
190723	12:07:57.93	44º46.21’	111º09.09’	12.2	1.5W	19	66	4	0.16
190723	12:13:13.68	44º34.92’	110º45.98’	8.3	0.8W	7	102	8	0.13
190723	12:21:24.49	44º35.00’	110º45.47’	6.9	0.6W	9	129	8	0.17
190723	12:28:28.52	44º45.88’	111º09.39’	7.6	0.3	10	103	3	0.13
190723	13:58:45.83	44º34.52’	110º46.12’	6.0	0.9W	12	106	8	0.20
190723	14:12:43.92	44º36.00’	110º45.48’	2.2	0.7	10	144	7	0.07
190723	14:46:21.61	44º34.35’	110º45.69’	2.5	0.7W	7	110	9	0.11
190723	14:52:56.12	44º34.51’	110º45.67’	7.3	0.9W	13	88	8	0.10
190723	14:53:51.70	44º34.63’	110º45.70’	6.4	0.4	7	132	8	0.10
190723	15:48:49.36	44º34.39’	110º45.35’	7.5	0.8W	15	86	9	0.18
190723	18:13:00.45	44º34.09’	110º44.89’	2.0	1.2	8	191	10	0.12
190723	19:10:33.51	44º34.63’	110º45.61’	6.0	0.7W	9	133	8	0.16
190724	00:45:45.94	44º34.28’	110º45.35’	7.0	1.7W	15	73	9	0.16
190724	03:32:46.60	44º34.12’	110º45.01’	2.1	0.9W	9	144	9	0.18
190724	03:36:05.64	44º34.58’	110º45.81’	7.8	1.4W	19	81	8	0.15
190724	03:59:54.84	44º34.57’	110º45.03’	5.9	0.6	9	138	9	0.15
190724	04:06:25.88	44º34.00’	110º45.41’	7.5	1.0	10	102	9	0.18
190724	04:57:30.12	44º45.69’	111º06.79’	10.0	0.3	14	74	4	0.17
190724	12:52:51.62	44º47.69’	111º18.04’	5.4	0.4	8	140	10	0.05
190724	15:26:27.65	44º34.12’	110º45.34’	7.2	1.7W	20	72	9	0.18
190724	15:27:08.04	44º34.07’	110º45.60’	6.5	1.1W	13	88	9	0.20
190724	15:39:21.84	44º34.68’	110º45.11’	6.1	0.8W	9	95	9	0.12
190724	15:40:30.63	44º35.49’	110º46.14’	8.4	0.3	6	118	7	0.18
190724	15:41:04.49	44º33.86’	110º45.94’	4.3	1.1W	11	90	9	0.22
190724	15:41:42.98	44º33.81’	110º45.58’	5.6	0.6	7	143	9	0.16
190724	15:55:53.87	44º34.20’	110º45.94’	6.3	1.2	9	135	9	0.18
190724	16:04:26.43	44º33.93’	110º45.17’	2.2	1.0W	12	101	10	0.14
190724	16:12:31.35	44º34.46’	110º45.58’	2.7	0.8	6	135	9	0.10
190725	04:36:26.89	44º34.17’	110º45.82’	7.9	1.1	8	113	9	0.23
190725	09:05:15.50	44º34.96’	110º45.76’	6.0	0.6W	12	99	8	0.12
190725	09:27:27.99	44º34.94’	110º45.47’	8.1	1.6W	14	96	8	0.15
190725	21:41:28.28	44º34.35’	110º46.29’	5.6	0.6	10	110	8	0.13
190726	21:29:37.43	44º44.62’	110º47.21’	6.1	0.5	11	99	7	0.19
190728	03:23:36.25	44º20.82’	111º00.29’	2.6*	1.8W	12	147	18	0.09
190728	03:32:50.12	44º20.58’	111º00.04’	2.1*	1.2	9	149	18	0.29
190728	04:34:54.82	44º34.29’	110º45.44’	2.2	1.0W	9	101	9	0.14
190730	19:30:00.97	44º47.99’	110º57.13’	4.8	0.4	12	235	6	0.13
190731	02:28:03.33	44º35.83’	110º19.54’	6.6	0.8	9	93	10	0.11
190731	18:43:06.21	44º43.85’	111º07.51’	11.1	0.4	18	71	6	0.18

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2019

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
190801	23:00:58.77	44º43.56’	111º07.85’	10.5	0.5	14	85	6	0.12
190802	06:16:44.02	44º27.75’	110º44.86’	6.7	0.6	9	145	7	0.12
190802	07:42:41.61	44º24.05’	110º36.21’	3.5	1.5W	15	140	4	0.16
190802	17:55:34.02	44º46.29’	110º57.78’	8.4	0.5	13	114	4	0.15
190803	11:55:07.59	44º43.65’	111º07.53’	14.7	-0.2	8	99	6	0.09
190803	11:55:35.68	44º43.71’	111º07.65’	12.8	0.0	12	72	6	0.19
190803	13:19:00.77	44º47.57’	110º36.54’	3.6	1.9W	20	80	10	0.14
190804	00:53:07.26	44º48.67’	111º29.29’	11.0	0.5	9	186	5	0.09
190806	15:35:04.94	44º38.27’	110º41.58’	5.1	2.0W	25	68	5	0.20
190806	15:35:15.22	44º38.26’	110º41.47’	6.2	1.6	17	77	5	0.22
190806	15:36:54.30	44º38.24’	110º41.73’	5.0	1.5W	17	79	5	0.21
190807	21:41:42.80	44º47.29’	110º37.51’	2.4	0.1	8	169	9	0.09
190808	03:05:34.03	44º42.64’	111º02.24’	11.1	1.7W	21	66	6	0.16
190808	03:13:37.94	44º42.82’	111º02.21’	10.8	1.2W	15	67	6	0.14
190808	03:13:51.22	44º42.69’	110º57.94’	2.0	-0.1	7	135	6	0.13
190808	03:28:12.60	44º37.98’	110º20.79’	5.7	0.9	12	82	9	0.11
190810	08:09:44.62	44º46.76’	111º12.68’	7.0	1.7W	14	92	3	0.21
190810	08:24:30.35	44º47.00’	111º12.31’	7.0	1.5W	13	88	4	0.18
190811	07:29:55.36	44º43.95’	111º08.83’	7.8	0.1	9	90	4	0.20
190811	17:01:42.26	44º44.56’	110º46.98’	5.0	0.8	10	156	7	0.17
190812	11:58:18.55	44º31.73’	110º13.04’	6.8	1.7W	15	100	4	0.13
190812	12:32:28.94	44º31.70’	110º12.80’	6.2	0.6	8	174	5	0.06
190812	12:38:36.50	44º45.58’	110º56.02’	8.2	0.4	7	154	6	0.07
190812	20:29:50.60	44º45.90’	110º56.12’	10.3	0.4	11	109	6	0.13
190812	20:29:53.66	44º49.09’	110º58.02’	3.1	1.3W	5	221	7	0.09
190813	11:49:47.69	44º47.49’	111º12.00’	8.0	1.6W	17	87	5	0.17
190813	12:41:07.67	44º47.59’	111º11.95’	8.0	1.8W	17	88	5	0.17
190814	07:00:45.07	44º47.37’	111º11.97’	8.2	2.3W	20	85	4	0.16
190814	07:03:57.99	44º47.07’	111º11.82’	6.7	-0.2	10	165	4	0.20
190814	13:21:44.25	44º47.04’	111º11.74’	5.2	0.6	16	83	4	0.15
190814	14:21:12.26	44º47.28’	111º11.85’	5.8	0.2	11	84	4	0.14
190814	16:46:29.08	44º47.52’	111º12.03’	8.3	2.1W	16	85	5	0.17
190815	08:29:50.96	44º00.77’	110º19.51’	8.9*	2.0W	12	175	42	0.11
190815	08:35:43.95	44º21.45’	110º46.74’	2.3*	1.1	9	162	11	0.08
190815	08:36:02.86	44º22.03’	110º46.83’	3.5	1.0	6	157	10	0.03
190815	19:46:39.64	44º07.66’	110º22.73’	7.4*	3.5W	36	103	24	0.22
190816	00:53:56.04	44º06.33’	110º21.89’	4.9*	1.0	9	159	32	0.16
190816	02:56:08.13	44º34.69’	110º36.99’	5.3	--	9	113	4	0.12
190816	02:56:12.13	44º33.26’	110º36.99’	1.4	0.9	10	178	6	0.16
190816	02:56:18.65	44º33.36’	110º37.59’	3.5	1.1	13	132	6	0.12
190816	03:04:23.44	44º06.55’	110º23.05’	7.9*	1.1	13	108	24	0.18
190816	03:42:53.91	44º33.82’	110º37.38’	4.9	1.2W	12	103	5	0.07
190816	06:51:57.96	44º06.25’	110º23.01’	4.9*	1.8W	10	186	33	0.13
190818	07:25:37.84	44º39.74’	110º43.98’	7.8	0.4	10	96	7	0.13
190818	11:01:04.14	44º39.60’	110º44.16’	8.4	1.1W	16	70	7	0.11

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DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
190819	00:39:45.62	44º39.07’	110º26.71’	3.0	1.1W	11	126	9	0.12
190819	00:40:08.84	44º39.19’	110º26.32’	3.4	1.6W	12	131	9	0.13
190819	21:47:07.87	44º36.46’	110º24.08’	2.3	0.4	13	144	5	0.21
190819	22:52:02.55	44º46.97’	110º59.98’	8.2	-0.1	11	148	3	0.18
190820	03:40:36.55	44º47.48’	111º00.29’	8.8	0.6	14	155	4	0.09
190820	05:53:37.79	44º47.10’	111º00.29’	8.5	1.5W	18	111	3	0.12
190820	12:05:16.51	44º47.05’	111º00.19’	8.1	0.3	9	200	3	0.11
190820	16:14:51.62	44º47.58’	110º59.87’	9.4	0.7	17	158	4	0.12
190820	16:15:03.69	44º47.76’	110º59.96’	8.6	1.1	13	161	4	0.10
190820	19:55:20.21	44º26.01’	110º29.71’	2.0	1.0W	10	114	6	0.26
190821	03:26:34.60	44º42.03’	111º01.09’	12.9	1.6W	18	62	7	0.12
190821	03:35:56.97	44º42.25’	111º00.87’	10.6	-0.2	8	153	6	0.08
190821	03:36:18.07	44º42.18’	111º00.86’	11.4	0.8	13	92	6	0.12
190821	08:18:58.95	44º34.01’	110º37.68’	6.7	2.2W	25	66	4	0.16
190821	11:04:36.61	44º38.09’	110º59.65’	11.3	0.6	17	53	9	0.12
190821	13:53:37.82	44º35.68’	110º38.68’	3.3	0.0	9	159	1	0.04
190821	13:53:41.98	44º36.49’	110º39.62’	1.9	1.2	7	172	1	0.01
190823	16:31:38.59	44º40.23’	111º13.28’	7.4	1.2W	17	105	5	0.19
190824	03:52:06.39	44º46.23’	110º48.26’	6.2	0.3	10	182	4	0.11
190825	09:53:03.49	44º27.55’	110º58.82’	8.1	-0.1	6	148	12	0.05
190826	15:27:06.41	44º44.71’	110º47.46’	11.5	0.7	15	98	7	0.17
190826	18:18:46.27	44º49.05’	111º29.26’	11.8	1.9W	21	79	5	0.13
190827	06:01:03.79	44º51.61’	111º28.72’	10.9	1.7W	23	86	5	0.14
190827	17:04:39.95	44º21.75’	110º31.18’	3.3	0.3	7	171	4	0.09
190827	17:05:00.37	44º19.80’	110º32.37’	3.6	0.6	10	113	7	0.14
190827	18:52:37.78	44º36.60’	111º01.35’	8.4	0.6	12	77	6	0.12
190828	01:20:22.72	44º46.69’	110º47.46’	3.0	1.0	16	92	5	0.15
190829	21:20:27.52	44º19.85’	110º31.96’	4.0	1.6W	11	115	7	0.15
190829	21:20:52.62	44º21.03’	110º32.07’	4.8	0.0	6	220	4	0.10
190829	21:28:21.31	44º21.77’	110º31.05’	2.6	0.8	7	245	4	0.06
190829	21:28:51.52	44º20.76’	110º31.66’	2.4	0.7	9	177	5	0.10
190829	21:29:24.49	44º23.11’	110º30.34’	1.8	0.2	8	162	3	0.07
190829	21:30:11.49	44º19.62’	110º32.14’	3.8	2.2W	14	114	7	0.17
190829	21:30:50.59	44º20.86’	110º31.59’	4.3	2.2W	12	177	5	0.14
190829	21:33:01.63	44º19.94’	110º31.53’	1.4	2.6W	19	121	7	0.17
190829	21:35:17.67	44º20.40’	110º31.70’	2.5	1.6W	10	180	6	0.16
190829	21:36:10.01	44º19.39’	110º32.29’	3.6	1.9W	11	115	7	0.16
190829	21:37:52.55	44º19.75’	110º32.79’	2.0	0.9	10	183	7	0.19
190829	21:38:00.70	44º22.14’	110º30.87’	2.6	1.9W	9	208	3	0.06
190829	21:38:43.86	44º20.38’	110º32.01’	2.2	0.8	9	225	6	0.14
190829	21:41:42.52	44º19.61’	110º32.33’	3.4	1.5W	10	114	7	0.15
190829	21:43:38.58	44º18.87’	110º32.34’	2.1	2.4W	18	62	8	0.16
190829	21:47:19.25	44º22.43’	110º30.67’	2.0	1.3	8	221	3	0.12
190829	21:49:48.79	44º21.84’	110º31.17’	1.9	1.7	9	212	3	0.07
190829	21:51:22.02	44º21.32’	110º31.38’	2.0	0.0	6	254	4	0.11

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DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
190829	21:51:45.36	44º22.65’	110º30.67’	2.0	1.5	6	214	3	0.05
190829	21:51:52.60	44º21.58’	110º31.10’	2.0	1.2	9	249	4	0.09
190829	21:53:10.29	44º22.42’	110º30.79’	2.0	0.8	6	223	3	0.07
190829	21:55:01.13	44º20.29’	110º32.37’	4.1	1.5W	11	226	6	0.14
190829	22:00:21.09	44º20.23’	110º32.02’	3.5	1.2W	10	181	6	0.09
190829	22:05:41.31	44º20.81’	110º31.70’	3.8	1.5W	10	177	5	0.08
190829	22:08:05.02	44º20.67’	110º31.74’	2.9	0.4	8	179	5	0.10
190829	22:22:08.75	44º20.37’	110º31.75’	2.2	1.3W	11	180	6	0.18
190829	22:24:12.58	44º19.78’	110º32.00’	2.0	2.7W	20	130	7	0.23
190829	22:39:39.47	44º22.61’	110º30.66’	2.0	0.3	6	215	3	0.07
190829	22:40:17.18	44º21.08’	110º31.03’	2.3	0.0	6	258	5	0.13
190829	22:43:37.14	44º20.69’	110º31.71’	2.5	0.8	10	179	5	0.14
190829	23:22:07.61	44º35.95’	110º19.55’	5.4	0.3	9	111	7	0.08
190829	23:27:32.25	44º21.34’	110º32.11’	9.4	0.5	8	173	4	0.21
190829	23:27:40.18	44º23.19’	110º30.34’	1.8	0.5	6	189	3	0.03
190829	23:28:11.59	44º21.13’	110º31.61’	3.7	0.9	11	175	4	0.10
190829	23:28:38.95	44º22.37’	110º30.85’	2.8	-0.1	6	226	3	0.07
190830	00:16:27.62	44º19.92’	110º32.13’	4.2	1.5W	14	130	6	0.12
190830	09:53:17.48	44º20.06’	110º32.26’	4.3	1.5W	13	112	6	0.11
190830	09:58:35.55	44º20.17’	110º31.79’	4.1	1.1W	15	113	6	0.16
190830	10:24:40.47	44º20.71’	110º31.77’	3.9	0.7	8	177	5	0.05
190830	10:29:04.25	44º20.99’	110º32.00’	4.5	1.1W	12	176	5	0.12
190830	10:30:49.77	44º19.90’	110º31.88’	4.2	1.4W	13	114	7	0.11
190830	10:32:40.79	44º19.77’	110º32.24’	4.4	1.6W	16	114	7	0.10
190830	11:16:39.79	44º19.68’	110º32.10’	4.4	1.4W	13	114	7	0.15
190830	12:15:57.10	44º20.45’	110º31.92’	4.3	0.5	7	180	6	0.02
190831	02:47:27.63	44º44.47’	110º46.79’	3.2	0.4	10	100	8	0.06
190831	10:14:17.99	44º41.89’	110º01.55’	13.3	1.0	11	91	9	0.13
190831	12:36:46.32	44º20.62’	110º31.78’	5.2	2.3W	13	179	5	0.13
190831	12:48:22.05	44º20.50’	110º31.61’	3.5	0.6	8	180	5	0.06
190831	12:53:29.23	44º20.05’	110º31.86’	1.7	2.1W	15	183	6	0.25
190831	12:55:45.05	44º20.02’	110º32.19’	3.7	1.5W	10	112	6	0.08
190831	12:57:19.36	44º20.61’	110º32.00’	3.8	1.6W	10	223	5	0.10
190831	12:57:42.36	44º21.77’	110º31.44’	3.2	1.0	7	212	3	0.05
190831	13:01:41.83	44º21.43’	110º31.69’	3.8	0.8	8	173	4	0.03
190831	13:04:49.69	44º19.83’	110º32.27’	3.3	1.3W	7	183	7	0.04
190831	14:11:16.46	44º20.97’	110º31.72’	2.9	0.8	10	176	5	0.06
190901	05:23:10.04	44º38.77’	110º44.91’	5.3	0.4	13	132	8	0.11
190901	05:31:27.91	44º46.60’	111º10.29’	14.9	0.2	13	138	3	0.14
190901	07:10:52.93	44º44.01’	111º08.63’	10.7	-0.1	12	85	5	0.13
190901	08:28:19.65	44º44.30’	111º14.44’	11.8	1.4W	16	127	3	0.16
190901	20:58:23.78	44º20.15’	110º31.84’	2.8	0.8	10	181	6	0.12
190903	16:39:18.86	44º45.62’	111º00.92’	4.0	0.1	11	128	1	0.17
190904	09:50:38.19	45º04.27’	110º25.68’	19.0	0.3	10	213	30	0.16
190904	09:53:55.86	44º44.68’	111º10.26’	12.3	0.6W	15	67	2	0.13

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190905	05:05:40.85	44º44.64’	110º57.27’	5.3	1.1W	20	95	4	0.14
190908	00:00:58.88	44º34.99’	110º44.96’	7.5	1.0	19	70	9	0.22
190908	00:01:27.04	44º34.92’	110º45.27’	7.1	1.3W	23	71	9	0.14
190908	11:55:27.79	44º29.60’	110º33.13’	5.8	0.8	9	125	7	0.11
190908	13:27:16.29	44º40.36’	110º27.23’	4.8	1.6W	15	99	6	0.19
190908	19:59:12.45	44º30.20’	111º06.42’	15.7	2.4W	25	135	11	0.23
190909	03:36:02.41	44º29.16’	111º03.92’	9.3	0.5W	16	153	14	0.18
190909	05:32:19.90	44º49.63’	110º51.45’	7.5	0.2	12	215	4	0.23
190909	19:04:20.34	44º46.75’	110º53.27’	1.4	-0.4	6	173	3	0.08
190912	09:10:39.54	44º26.51’	110º58.45’	7.6	0.9W	9	130	11	0.21
190912	10:46:43.54	44º27.43’	110º58.59’	4.1*	0.5W	10	211	11	0.33
190912	23:55:59.01	44º42.08’	111º04.36’	12.9	0.4	12	83	8	0.11
190914	19:38:35.19	45º07.49’	110º37.39’	13.0	1.5	14	181	18	0.15
190915	06:02:13.18	44º39.06’	111º05.27’	5.8	0.6W	17	107	5	0.16
190915	19:58:41.85	44º27.34’	110º36.30’	3.5	1.5W	15	80	2	0.12
190916	10:04:21.06	44º22.60’	110º45.95’	2.0	1.0	11	110	10	0.19
190916	18:30:02.73	44º44.60’	111º09.41’	8.5	0.9	15	65	3	0.18
190917	10:43:28.84	44º27.25’	110º56.41’	2.9	1.4W	14	107	8	0.26
190917	11:20:56.85	44º27.06’	110º55.14’	2.0	0.7W	9	104	7	0.20
190917	13:46:08.95	44º34.87’	110º23.42’	2.3	0.7	9	119	2	0.09
190918	05:03:54.06	44º44.75’	111º09.76’	9.2	0.9	14	71	3	0.17
190918	06:34:56.04	44º10.50’	110º36.18’	10.3	1.5W	13	135	12	0.06
190918	16:12:38.58	44º45.60’	111º06.41’	10.6	-0.1	10	81	4	0.14
190919	03:48:35.19	44º40.48’	110º03.19’	10.3	1.3W	11	91	11	0.19
190919	13:50:41.00	44º35.45’	110º22.80’	4.4	1.8W	14	68	3	0.15
190920	04:25:24.79	44º40.76’	110º01.30’	10.0	--	6	174	10	0.13
190920	06:54:45.00	44º39.74’	110º01.30’	9.8	1.5	12	108	11	0.19
190920	07:06:49.15	44º40.33’	110º01.14’	11.6	1.2	8	180	10	0.15
190920	07:07:03.21	44º46.07’	110º58.20’	4.4	-0.7	6	184	3	0.03
190920	09:05:45.54	44º32.90’	110º27.88’	3.8	0.6	11	87	5	0.09
190920	10:21:15.90	44º32.90’	110º27.24’	3.3	1.5W	15	109	4	0.12
190920	10:46:21.79	44º33.18’	110º27.29’	3.4	2.0W	24	77	4	0.17
190920	22:12:05.94	44º46.03’	111º09.84’	5.7	-0.1	12	116	3	0.19
190921	03:17:42.23	44º28.91’	110º46.29’	4.9	1.3W	12	87	6	0.14
190921	03:17:51.71	44º28.88’	110º45.89’	2.8	0.1	9	115	7	0.10
190921	03:19:48.75	44º41.20’	110º27.46’	4.2	1.4W	17	109	5	0.21
190921	18:36:43.57	44º38.38’	110º23.45’	8.1	1.5W	10	100	8	0.15
190921	19:23:38.33	44º13.06’	110º56.19’	6.5	0.8	8	163	12	0.08
190922	22:17:55.57	44º20.15’	110º32.32’	4.3	0.6	9	101	6	0.09
190923	00:38:24.38	44º33.54’	111º09.94’	10.4	1.2W	17	114	7	0.15
190923	04:25:02.78	44º40.80’	110º44.87’	7.7	0.1	16	78	6	0.15
190923	11:55:38.95	44º36.79’	110º18.83’	4.6	1.6W	18	94	9	0.11
190923	13:09:48.41	44º36.51’	110º18.74’	4.9	0.7	10	96	8	0.08
190925	14:45:52.51	44º46.69’	110º47.84’	3.4	0.6	11	108	4	0.13
190926	12:33:50.08	44º35.20’	110º44.11’	7.4	0.6	10	135	8	0.09

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2019

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
190926	13:08:28.94	44º35.60’	110º43.64’	8.0	0.8W	14	131	7	0.10
190926	13:26:50.30	44º46.91’	111º00.12’	8.2	0.8W	19	147	3	0.18
190926	13:34:32.11	44º46.92’	111º00.33’	7.7	0.5	16	147	3	0.16
190926	14:29:14.19	44º46.94’	111º00.47’	10.8	0.0	16	147	3	0.19
190926	14:29:28.83	44º46.90’	111º00.55’	10.4	0.9W	18	119	2	0.18
190926	14:53:23.35	44º46.84’	111º00.63’	7.2	0.8W	12	146	2	0.15
190926	14:53:26.26	44º46.24’	110º57.31’	4.4	1.0W	12	245	9	0.15
190926	15:04:38.03	44º47.30’	111º00.56’	11.8	0.8W	14	152	3	0.14
190927	09:14:39.65	44º35.21’	110º22.47’	1.9	1.5W	16	100	3	0.20
190927	09:50:05.37	44º50.39’	110º58.86’	5.9	0.4	14	203	9	0.15
190927	15:16:59.06	44º25.80’	110º59.34’	5.0*	0.3	10	125	12	0.17
190927	15:17:21.18	44º25.89’	110º56.26’	11.1	0.0	8	203	8	0.12
190928	05:28:18.25	44º37.94’	110º20.64’	4.1	0.8	10	74	9	0.06
190928	10:47:14.48	44º44.37’	110º47.78’	4.3	1.0W	13	144	7	0.09
190928	10:47:31.83	44º44.50’	110º47.80’	2.4	-0.2	7	146	7	0.08
190930	10:29:13.03	44º41.71’	110º01.62’	14.1	1.3	11	93	9	0.11
190930	10:58:38.04	44º20.05’	110º31.89’	4.3	1.3W	15	106	6	0.15
190930	11:48:52.11	44º18.26’	110º59.77’	11.4	0.9	9	117	16	0.14

number of earthquakes = 333
* indicates poor depth control
W indicates Wood-Anderson data used for magnitude calculation

Table 3
UNIVERSITY OF UTAH YELLOWSTONE SEISMIC NETWORK
Operating Seismograph Stations
September 30, 2019

SEED Station	Location	SEED Channel	No. of Channels	Network Code	Latitude	Longitude	Elevation (meters)	Sensor	Digitizer	Telemetry	Sponsor
B206*	Canyon206bwy2008, Yellowstone, WY	EH[ZEN]	3	PB	44° 46.66′	110° 30.70′	2400	IESE-S2	Q330	Digital	PBO
B207*	Madisn207bwy2007, Yellowstone, WY	EH[ZEN]	3	PB	44° 37.14′	110° 50.91′	2182	IESE-S2	Q330	Digital	PBO
B208*	Lakejn208bwy2008, Yellowstone, WY	EH[ZEN]	3	PB	44° 33.61′	110° 24.09′	2406	IESE-S2	Q330	Digital	PBO
B944*	Grantt944bwy2008, Yellowstone, WY	EH[ZEN]	3	PB	44° 23.38′	110° 32.63′	2365	IESE-S2	Q330	Digital	PBO
B945*	Panthr944swy2008, Yellowstone, WY	EH[ZEN]	3	PB	44° 53.64′	110° 44.65′	2249	IESE-S2	Q330	Digital	PBO
B950*	Norris950bwy2013, Yellowstone, WY	EH[ZEN]	3	PB	44° 42.77′	110° 40.71′	2328	IESE-S2	Q330	Digital	PBO
FLWY*	Flagg Ranch, WY	BH[ZEN]	3	IW	44° 04.96′	110° 41.96′	2078	3ESP	RT-130	Digital	ANSS
IMW*	Indian Meadows, WY	BH[ZEN]	3	IW	43° 53.58′	110° 56.58′	2670	3ESP	RT-130	Digital	ANSS
LKWY*	Lake, WY	BH[ZEN]	3	US	44° 33.91′	110° 24.00′	2424	STS-2	Q330	Digital	USGS
LOHW*	National Elk Refuge, WY	BH[ZEN]	3	IW	43° 36.76′	110° 36.30′	2245	3ESP	RT-130	Digital	ANSS
MCID	Moose Creek, ID	EHZ	1	WY	44° 11.45′	111° 11.03′	2137	L4C	PSN	Analog	USGS
MOOW*	Moose Ponds, WY	BH[ZEN]	3	IW	43° 44.92′	110° 44.69′	2128	3ESP	RT-130	Digital	ANSS
QLMT*	Earthquake Lake, MT	EHZ	1	MB	44° 49.84′	111° 25.80′	2064	L4C	-	Analog	MBMT
REDW*	Red-Top Meadows, WY	BH[ZEN]	3	IW	43° 21.74′	110° 51.18′	2322	3ESP	RT-130	Digital	ANSS
SNOW*	Snow King Mountain, WY	BH[ZEN]	3	IW	43° 27.75′	110° 45.31′	2390	3ESP	RT-130	Digital	ANSS
TPAW*	Teton Pass, WY	BH[ZEN]	3	IW	43° 29.41′	110° 57.04′	2512	3ESP	RT-130	Digital	ANSS
TPMT*	Teepe Creek, MT	EHZ	1	MB	44° 43.79′	111° 39.94′	2518	L4C	-	Analog	MBMT
YDC	Denny Creek, MT	EHZ	1	WY	44° 42.51′	111° 14.60′	2025	L4C	PSN	Analog	USGS
YDD	Grant Junction, Yellowstone, WY	HH[ZEN]	3	WY	44° 24.00′	110° 34.80′	2400	STS-2	Q330	Digital	NSF
		EN[ZEN]	3					Episensor			
YEE	East Entrance (YNP), WY	HH[ZEN]	3	WY	44° 29.12′	109° 53.81′	2270	Compact	Centaur	Digital	USGS
YFT	Old Faithful (YNP), WY	HH[ZEN]	3	WY	44° 27.05′	110° 50.24′	2292	Compact	Centaur	Digital	USGS
		EN[ZEN]	3					Titan			
YGC	Grayling Creek, MT	EHZ	1	WY	44° 47.77′	111° 06.45′	2075	L4C	PSN	Analog	USGS
YHB	Horse Butte, MT	EHZ	1	WY	44° 45.07′	111° 11.71′	2157	L4C	PSN	Analog	USGS
		HH[ZEN]	3					Compact	ANSS-130	Digital	
		EN[ZEN]	3					Titan			
YHH	Holmes Hill (YNP), WY	EHZ	1	WY	44° 47.30′	110° 51.03′	2717	S13	PSN	Analog	USGS
		HH[ZEN]	3					Trillium 120	Q330	Digital	
		EN[ZEN]	3					Titan			

SEED Station	Location	SEED Channel	No. of Channels	Network Code	Latitude	Longitude	Elevation (meters)	Sensor	Digitizer	Telemetry	Sponsor
YHL	Hebgen Lake, MT	HH[ZEN]	3	WY	44° 51.05′	111° 10.98′	2691	Trillium 120	Q330	Digital	USGS
		EN[ZEN]	3					Titan			
YHR	Hawk's Rest, WY	HH[ZEN]	3	WY	44° 06.36′	110° 04.90′	2976	Trillium 120	Q330	Digital	USGS
YJC	Joseph′s Coat (YNP), WY	EH[ZEN]	3	WY	44° 45.33′	110° 20.95′	2684	S13	PSN	Analog	USGS
YLA	Lake Butte (YNP), WY	EHZ	1	WY	44° 30.76′	110° 16.12′	2580	L4C	PSN	Analog	USGS
YLT	Little Thumb Creek (YNP), WY	EHZ	1	WY	44° 26.25′	110° 35.28′	2439	L4C	PSN	Analog	USGS
YMC	Maple Creek (YNP), WY	EH[ZEN]	3	WY	44° 45.53′	111° 00.41′	2073	S13	PSN	Analog	USGS
YML	Mary Lake (YNP), WY	EH[ZEN]	3	WY	44° 36.20′	110° 38.63′	2653	S13	PSN	Analog	USGS
YMP	Mirror Plateau (YNP), WY	EHZ	1	WY	44° 44.38′	110° 09.40′	2774	S13	PSN	Analog	USGS
		HH[ZEN]	3					Trillium 120	Q330	Digital	
		EN[ZEN]	3					Titan			
YMR	Madison River (YNP), WY	HH[ZEN]	3	WY	44° 40.12′	110° 57.90′	2149	Trillium 120	Q330	Digital	USGS
		EN[ZEN]	3					Titan			
YMS	Mount Sheridan (YNP), WY	EHZ	1	WY	44° 15.84′	110° 31.67′	3106	L4C	PSN	Analog	USGS
YMV	Mammoth Vault (YNP), WY	EHZ	1	WY	44° 58.42′	110° 41.33′	1829	L4C	PSN	Analog	USGS
YNE	Northeast Entrance (YNP), WY	HH[ZEN]	3	WY	45° 00.46′	110° 00.48′	2343	Compact	Centaur	Digital	USGS
YNM	Norris Museum (YNP), WY	HH[ZEN]	3	WY	44° 43.59′	110° 42.22′	2311	Trillium 240	Q330	Digital	USGS
YNR	Norris Junction (YNP), WY	HH[ZEN]	3	WY	44° 42.93′	110° 40.75′	2336	Trillium 120	Q330	Digital	USGS
		EN[ZEN]	3					Titan			
YPC	Pelican Cone (YNP), WY	EHZ	1	WY	44° 38.88′	110° 11.55′	2932	L4C	PSN	Analog	USGS
YPK	Parker Peak (YNP), WY	EH[ZEN]	3	WY	44° 43.91′	109° 55.32′	2897	L4C	PSN	Analog	USGS
YPM	Purple Mountain (YNP), WY	EHZ	1	WY	44° 39.43′	110° 52.12′	2582	L4C	PSN	Analog	USGS
YPP	Pitchstone Plateau (YNP), WY	EHZ	1	WY	44° 16.26′	110° 48.27′	2707	S13	PSN	Analog	USGS
		HH[ZEN]	3					Trillium 120	Q330	Digital	
		EN[ZEN]	3					Titan			
YSB	Soda Butte (YNP), WY	EHZ	1	WY	44° 53.04′	110° 09.06′	2072	L4C	PSN	Analog	USGS
YTP	The Promontory (YNP), WY	EHZ	1	WY	44° 23.51′	110° 17.10′	2384	L4	PSN	Analog	USGS
		HH[ZEN]	3					Trillium 120	Q330	Digital	
		EN[ZEN]	3					Titan			
YUF	Upper Falls (YNP), WY	HH[ZEN]	3	WY	44° 42.76′	110° 30.71′	2394	40T	ANSS-130	Digital	USGS
		EN[ZEN]	3					Titan			
YWB	West Boundary (YNP), WY	EHZ	1	WY	44° 36.35′	111° 06.05′	2310	L4C	PSN	Analog	USGS

* Station operated by another agency and recorded as part of the Yellowstone Seismic Network
Network Statistics: 150 data channels from 46 stations were being recorded at the end of this report period

EXPLANATION OF TABLE

UURSN Code: Station code formerly used in routine processing. Owing to software limitations, the station code may not be the same code used by the original operator. For multi-component stations, the vertical, east-west, and north-south high gain (low gain) components are identified by an appended Z(V), E(L), and N(M), respectively, in UUSS phase files.

Location: General description of station location. YNP = Yellowstone National Park.

SEED Station: The SEED (Standard for the Exchange of Earthquake Data) station code used by the original operator.

SEED Channel: The SEED format uses three letters to name seismic channels. See <<http://www.iris.edu/manuals/SEEDManual_V2.4.pdf>> for information about the SEED channel naming convention. Relevant sections are reproduced below. In the SEED convention, each letter describes one aspect of the instrumentation and its digitization. The first letter specifies the general sampling rate and the response band of the instrument. Band codes used in this table include:

Band Code	Band Type	Sample Rate	Corner Period
E	Extremely short period	≥ 80 Hertz	< 10 seconds
H	High broadband	≥ 80 Hertz	≥ 10 seconds
B	Broadband	≥ 10 to < 80 Hertz	≥10 seconds
S	Short period	≥ 10 to < 80 Hertz	< 10 seconds

The second letter specifies the family to which the sensor belongs. Sensor families used in this table are:

Instrument Code	Description
H	High gain seismometer
L	Low gain seismometer
N	Accelerometer

The third letter specifies the physical configuration of the members of a multiple axis instrument package. Channel orientations used in this table are:

Z E N Traditional (Vertical, East-West, North-South)

Number of Channels: Total number of waveform channels recorded.

Network Code: The FDSN (Federation of Digital Seismographic Networks) registered network code. See <<http://www.iris.edu/dms/nodes/dmc/services/network_codes>> for information about registered seismograph network codes. Network codes referenced in this table:

Network Code	Network name; Network operator or responsible organization
IE	Idaho National Laboratory Seismic Network
IU	IRIS/USGS Network; USGS Albuquerque Seismological Laboratory
IW	Intermountain West Network, U.S. Geological Survey

MB	Montana Regional Seismic Network; Montana Bureau of Mines and Geology
PB	Plate Boundary Observatory
UU	University of Utah Regional Network; University of Utah
US	US National Network; USGS National Earthquake Information Center
WY	Yellowstone Wyoming Seismic Network; University of Utah

Latitude, Longitude: Sensor location in degrees and decimal minutes; North latitude, West longitude.

Elevation: Sensor altitude in meters above sea level.

Sensor	**Description**
L4, L4C	Mark Products L4 or L4C short-period seismometer
S13, 18300	Geotech S13 or 18300 short-period seismometer
Ranger	Kinemetrics Ranger short-period seismometer
40T	Guralp CMG-40T broadband seismometer
3T	Guralp CMG-3T broadband seismometer
3ESP	Guralp CMG-3ESP broadband seismometer
STS-2	Streckheisen STS-2 broadband seismometer
FBA23	Kinemetrics FBA-23 accelerometer
EpiSensor	Kinemetrics EpiSensor accelerometer
Applied Mems	Applied Mems accelerometer
PA-23	Geotech PA-23 accelerometer
Compact	Nanometrics Compact broadband seismometer
Trillium 120	Nanometrics Trillium 120 broadband seismometer
Trillium 240	Nanometrics Trillium 240 broadband seismometer
Titan	Nanometrics Titan accelerometer
Observer	Refraction Technology (REF TEK) Model 151 Observer broadband seismometer
IESE-S2	Institute of Earth Science and Engineering S-2 model borehole seismometer

Digitizer	**Description**
K2	Kinemetrics Altus Series K2 (19-bit resolution field digitizer)
Etna	Kinemetrics Altus Series Etna (18-bit resolution field digitizer)
72A-07	Refraction Technology (REF TEK) model 72A-07 (24-bit field digitizer)
72A-08	Refraction Technology (REF TEK) model 72A-08 (24-bit field digitizer)
ANSS-130	Refraction Technology (REF TEK) model 130-ANSS/02 (24-bit resolution field digitizer)
RT-130	Refraction Technology (REF TEK) model RT-130 (24-bit resolution field digitizer)
Q330	Quanterra, Inc Q330 digitizer (24-bit resolution field digitizer)
SMART-24	Geotech SMART-24 digitizer (24-bit resolution field digitizer)
PSN	PSN-ADC-SERIAL version III (16-bit resolution field digitizer)
Basalt	Kinemetrics Basalt (24-bit resolution field digitizer)
Taurus	Nanometrics Taurus (24-bit resolution field digitizer)
Centaur	Nanometrics Centaur (24-bit resolution field digitizer)

Telemetry	Description
Analog	Data transmission is analog along part of the transmission pathway
Digital	Data are converted to digital form at the station site
None	On-site recording system

Sponsor (or Operator for stations marked by * in preceding columns)

USGS	U.S. Geological Survey
Utah	State of Utah
ANSS	Advanced National Seismic System
INL	Idaho National Laboratory
MBMT	Montana Bureau of Mines and Geology
PBO	Plate Boundary Observatory
NSF	National Science Foundation

Network Changes During July 1–September 30, 2019

None