EARTHQUAKE ACTIVITY IN THE YELLOWSTONE REGION

Preliminary Epicenters

April 1 – June 30, 2016

September 22, 2016

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).

EARTHQUAKE ACTIVITY IN THE YELLOWSTONE REGION
April 1 – June 30, 2016

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During the three-month period April 1 through June 30, 2016, the University of Utah Seismograph Stations (UUSS) located 194 earthquakes within the Yellowstone region (Figure 1). The total includes 11 earthquakes in the magnitude 2 range. The largest event to occur during this period was a magnitude 2.9 earthquake on June 30th. No earthquakes were 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 2016). 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 *http://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

None

Notable Swarm Seismicity

During the report period, there was one earthquake swarm 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 11 earthquakes ($-0.1 \leq M \leq 1.5$) occurred about 6.6 miles E of Grant Village, Yellowstone National Park on April 17th.

This swarm is labeled in Figure 1.
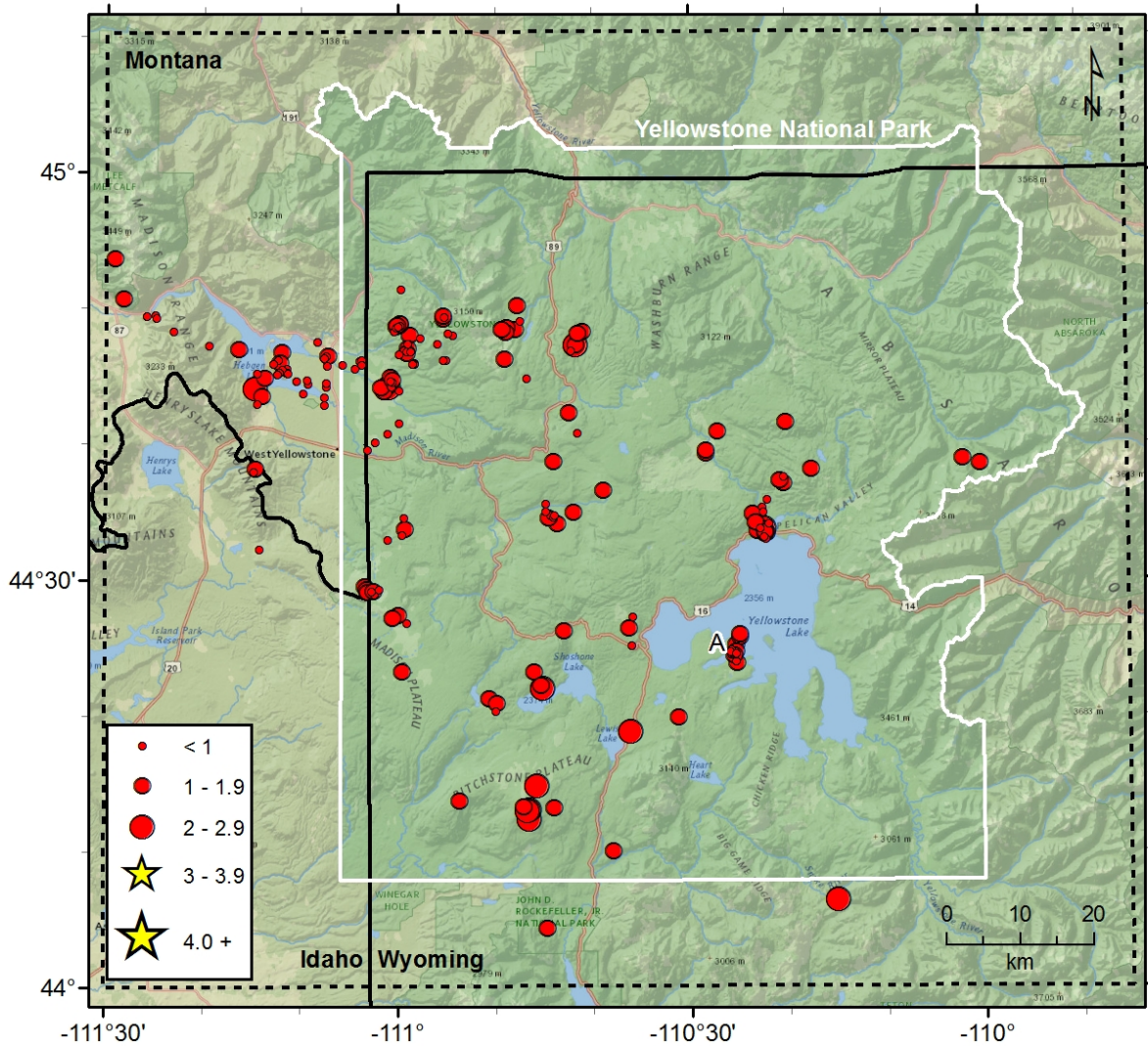
Figure 1. Earthquake epicenters located by the University of Utah Seismograph Stations, April 1, 2016 through June 30, 2016. Earthquakes of magnitude 3.0 and larger are depicted as yellow stars. The earthquake swarm labeled A is discussed in the text.

Table 1

EARTHQUAKES FELT IN THE YELLOWSTONE REGION
January 1, 2016 to June 30, 2016

Date	Time†	Felt Information‡	Latitude	Longitude	Magnitude§
None					

† 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 (*http://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.
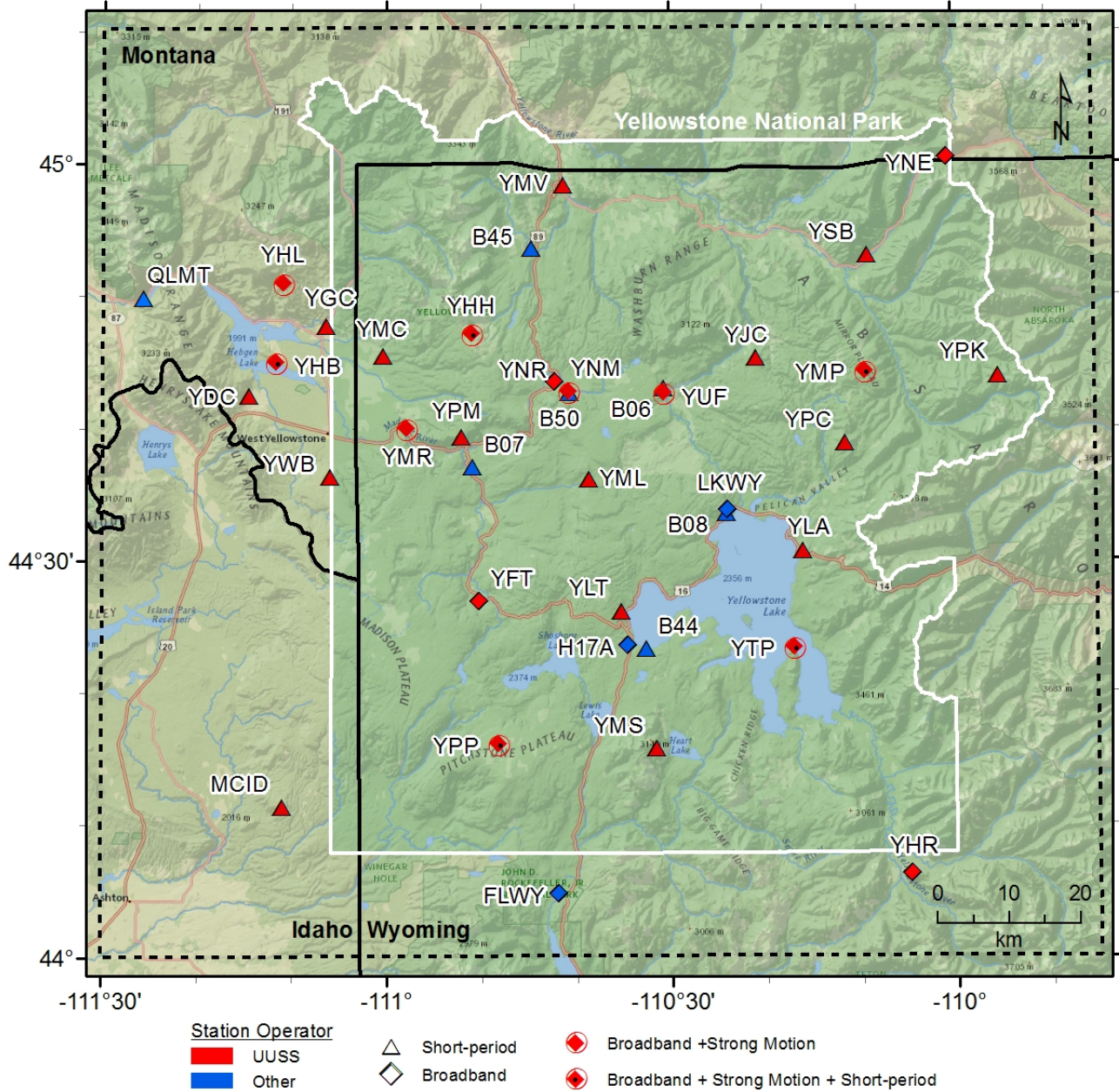
Yellowstone Seismic Network
June 30, 2016

Figure 2

Table 2. Earthquakes in the Yellowstone Region: April 1–June 30, 2016

Date	Origin Time	Latitude	Longitude	Depth	Mag	No	Gap	Dmn	Rms
160404	23:22:52.58	44°50.68'	111°28.30'	11.7	1.4	17	104	4	0.17
160407	13:26:28.02	44°42.31'	110°42.49'	1.3	1.0	5	138	3	0.03
160407	18:54:58.28	44°45.59'	111°11.44'	10.8	0.8	12	125	1	0.18
160407	18:55:17.91	44°44.66'	111°10.45'	6.9	-0.1	8	118	2	0.14
160407	19:29:31.40	44°46.22'	111°12.37'	10.8	0.7	11	228	2	0.12
160407	19:52:58.50	44°43.73'	111°09.73'	3.3	0.1	5	138	4	0.00
160408	05:57:21.31	44°32.27'	111°14.27'	14.8	0.8	15	162	13	0.17
160409	10:57:12.71	44°40.93'	110°27.21'	5.9	1.4W	13	214	6	0.11
160410	07:14:26.44	44°46.78'	111°11.92'	15.1	1.6W	21	67	3	0.19
160410	07:14:42.15	44°46.04'	111°12.15'	9.6	1.4	8	87	2	0.07
160410	12:28:21.80	44°34.65'	110°59.45'	8.6	0.7	10	133	9	0.07
160410	21:34:37.02	44°46.31'	110°49.00'	4.4	1.6W	17	81	3	0.14
160411	07:12:18.41	44°35.01'	110°22.54'	4.3	0.0	10	168	3	0.10
160411	14:20:53.99	44°46.14'	111°03.98'	10.7	0.6	13	128	4	0.11
160412	17:24:53.94	44°45.87'	111°03.74'	10.3	0.3	16	124	4	0.13
160414	19:38:28.71	44°45.78'	111°07.28'	7.3	0.3	7	119	4	0.06
160415	13:43:52.22	44°46.23'	111°03.76'	10.9	0.5	13	133	4	0.13
160417	12:41:07.21	44°24.57'	110°25.49'	4.2	0.6	11	113	10	0.13
160417	12:41:22.15	44°24.78'	110°25.36'	3.8	1.1	13	105	10	0.13
160417	12:41:37.90	44°24.54'	110°25.84'	2.1	0.6	10	112	9	0.20
160417	12:42:17.65	44°24.09'	110°25.38'	9.9	0.8	13	105	10	0.18
160417	12:47:56.75	44°24.49'	110°25.57'	4.2	1.0	11	113	10	0.07
160417	12:48:08.50	44°24.54'	110°25.64'	1.7	0.5	12	113	10	0.27
160417	12:48:27.96	44°24.65'	110°25.58'	3.8	0.3	11	111	10	0.11
160417	12:49:08.83	44°24.74'	110°25.94'	2.0	0.1	11	111	9	0.23
160417	12:49:54.30	44°24.88'	110°25.88'	2.2	0.6	12	109	9	0.16
160417	12:50:33.03	44°24.63'	110°25.37'	3.6	-0.1	6	157	10	0.13
160417	12:53:32.05	44°23.94'	110°25.27'	7.5	1.5W	18	106	10	0.15
160418	21:39:06.29	44°39.52'	110°28.43'	4.8	1.5W	12	108	7	0.20
160418	21:39:06.39	44°39.35'	110°28.38'	3.1	1.6W	13	93	7	0.11
160420	04:24:53.16	44°43.01'	111°14.53'	13.5	0.3	10	145	1	0.18
160420	05:03:05.09	44°43.57'	111°14.03'	12.4	1.0W	14	100	2	0.14
160420	15:59:09.08	44°34.88'	110°23.58'	2.0	1.7W	14	78	2	0.15
160420	20:26:23.14	44°40.78'	111°01.10'	7.7	0.4	8	147	4	0.07
160420	22:54:29.41	44°34.27'	110°23.31'	2.6	1.6W	13	88	1	0.12
160422	18:04:37.78	44°43.49'	111°07.57'	2.5	0.8W	9	89	6	0.08
160423	19:50:44.18	44°48.05'	110°54.39'	10.1	0.6W	12	182	5	0.08
160424	02:53:29.24	44°47.32'	110°41.71'	4.1	1.8W	12	199	8	0.16
160424	03:48:55.04	44°47.31'	110°41.77'	4.0	2.0W	21	96	8	0.20
160424	05:28:51.58	44°40.83'	110°41.57'	-0.7	0.6W	7	250	4	0.24
160424	05:31:11.49	44°46.88'	110°42.20'	4.2	0.4	12	194	8	0.23
160424	05:32:16.78	44°48.30'	110°41.04'	4.4	1.8W	14	208	10	0.16
160424	06:07:39.64	44°48.15'	110°41.53'	4.2	1.6W	19	205	10	0.15
160424	10:46:10.87	44°18.89'	110°36.22'	1.5	2.0W	11	111	8	0.11
160424	20:42:57.47	44°37.58'	110°20.47'	3.5	0.7	13	80	8	0.17

Table 2. Earthquakes in the Yellowstone Region: April 1–June 30, 2016

Date	Origin Time	Latitude	Longitude	Depth	Mag	No	Gap	Dmn	Rms
160426	02:08:39.75	44º20.40'	110º50.01'	6.6	0.6	8	118	8	0.08
160426	02:09:14.22	44º20.98'	110º49.87'	4.5	1.0	11	106	9	0.15
160426	02:09:54.94	44º21.36'	110º50.67'	2.0	1.4	12	124	10	0.11
160426	20:30:39.21	44º36.62'	110º38.93'	6.7	1.2W	12	152	1	0.11
160429	09:58:28.24	44º41.58'	110º59.94'	4.5	0.7	9	136	4	0.07
160429	16:05:58.29	44º34.83'	110º44.36'	6.4	0.9W	10	119	8	0.11
160429	16:09:27.32	44º34.79'	110º43.94'	5.9	0.7	12	122	8	0.14
160501	02:33:49.37	44º26.89'	110º59.13'	6.0*	0.8W	8	190	12	0.11
160504	07:24:50.29	44º45.96'	110º58.50'	8.3	-0.1	14	135	3	0.16
160504	07:26:05.72	44º46.01'	110º58.30'	7.8	0.7W	16	135	3	0.17
160504	07:26:33.35	44º45.92'	110º58.31'	8.2	0.6W	17	135	3	0.18
160506	00:59:23.06	44º45.88'	111º05.77'	9.7	0.6W	12	117	7	0.11
160506	13:52:23.34	44º44.47'	111º09.25'	4.4	-0.2	8	90	3	0.06
160506	20:40:09.05	44º44.76'	111º09.35'	3.8	-0.2	7	157	3	0.04
160506	22:11:02.50	44º28.98'	111º02.48'	14.6	0.8	10	141	14	0.08
160506	23:05:27.31	44º29.32'	111º02.00'	19.5	0.8	9	137	14	0.09
160506	23:08:36.40	44º29.21'	111º02.60'	16.9	1.1W	15	142	14	0.17
160506	23:16:29.75	44º29.55'	111º03.45'	17.3	1.4W	18	133	13	0.20
160506	23:42:34.36	44º29.34'	111º03.27'	14.8	1.4W	17	132	13	0.15
160506	23:42:34.40	44º29.16'	111º03.11'	14.8	1.3W	17	132	14	0.13
160507	18:34:40.37	44º23.32'	110º46.03'	2.9	1.1	9	83	9	0.12
160508	10:03:50.77	44º29.19'	111º02.74'	17.1	0.6W	12	143	14	0.09
160509	16:35:23.03	44º45.31'	111º11.53'	9.8	0.7	10	146	1	0.15
160510	06:14:59.02	44º04.47'	110º44.77'	9.1	0.9	7	124	4	0.20
160510	18:39:39.84	44º46.68'	110º59.90'	4.1	0.1	10	144	2	0.06
160512	01:22:32.74	44º19.93'	110º31.26'	7.9	1.4W	18	115	7	0.13
160513	02:58:02.94	44º46.24'	110º55.04'	8.5	0.3	13	135	6	0.14
160513	05:03:29.41	44º46.22'	110º55.36'	9.9	0.2	12	136	6	0.07
160513	10:40:51.13	44º47.41'	110º55.93'	11.9	0.5W	8	162	6	0.19
160513	13:42:39.51	44º34.21'	110º43.69'	9.1	1.2	7	120	8	0.07
160513	13:43:48.93	44º35.05'	110º41.98'	12.3	1.3W	12	101	5	0.11
160513	15:19:20.36	44º38.18'	110º17.61'	2.5	1.6W	8	98	8	0.12
160513	15:19:22.13	44º37.09'	110º20.45'	2.5	1.6W	8	155	8	0.11
160514	22:55:52.33	44º34.64'	110º44.57'	5.9	1.1W	15	69	8	0.13
160516	10:44:16.27	44º44.60'	111º00.60'	7.2	0.6W	13	81	2	0.20
160516	13:10:49.08	44º37.34'	110º20.80'	7.1	1.4	8	128	8	0.04
160516	21:27:15.81	44º44.10'	111º14.65'	12.3	2.4W	24	95	3	0.15
160518	11:50:55.05	44º37.96'	111º14.88'	8.5	0.9W	18	116	9	0.12
160518	11:50:55.11	44º38.17'	111º14.72'	9.2	1.0W	17	114	8	0.12
160518	14:41:58.80	44º44.97'	111º00.82'	8.3	1.1W	15	77	1	0.08
160518	14:52:24.81	44º33.81'	110º59.29'	14.1	1.2W	16	121	10	0.09
160518	14:57:05.85	44º44.75'	111º00.60'	7.8	1.0W	15	60	2	0.09
160518	15:38:15.19	44º44.35'	111º00.83'	8.1	0.8W	15	71	2	0.10
160519	00:53:54.79	44º25.29'	110º25.35'	2.7	1.7	7	144	10	0.09
160519	05:26:24.78	44º48.19'	110º54.83'	5.4	0.6W	9	231	5	0.05

Table 2. Earthquakes in the Yellowstone Region: April 1–June 30, 2016

Date	Origin Time	Latitude	Longitude	Depth	Mag	No	Gap	Dmn	Rms
160519	10:49:30.53	44º49.38'	110º55.25'	7.0	0.8W	10	202	7	0.07
160520	12:56:52.56	44º49.43'	111º25.90'	8.8	0.6	7	128	1	0.06
160520	19:18:22.25	44º49.22'	110º55.32'	6.8	1.3W	12	127	7	0.12
160521	02:29:24.04	44º33.35'	110º59.61'	13.6	0.9W	11	103	10	0.11
160521	07:03:19.86	44º49.46'	110º55.31'	7.2	0.9W	13	203	7	0.08
160521	19:05:59.17	44º26.28'	110º43.01'	5.6	1.0W	9	99	10	0.12
160521	21:57:55.44	44º27.31'	110º35.97'	4.2	0.9	9	143	2	0.06
160521	21:58:33.45	44º25.26'	110º36.10'	1.6	0.9	5	110	2	0.05
160521	22:05:38.71	44º44.66'	111º00.80'	7.9	0.2	10	105	2	0.13
160521	22:06:02.70	44º26.52'	110º36.33'	4.5	1.2	8	135	1	0.14
160522	20:21:47.43	44º25.82'	110º24.99'	7.9	1.3W	10	90	11	0.13
160522	21:33:52.09	44º26.01'	110º24.94'	2.0*	1.3W	8	127	11	0.22
160523	21:09:35.00	44º49.29'	111º24.86'	14.4	0.9	9	145	2	0.15
160523	21:10:00.61	44º49.49'	111º24.96'	14.1	0.9	11	140	1	0.16
160524	20:46:21.82	44º48.62'	111º00.12'	8.5	0.7W	9	214	6	0.15
160525	02:43:34.96	44º48.88'	110º59.85'	8.4	1.1W	11	178	6	0.08
160527	20:02:01.90	44º44.17'	111º00.94'	8.4	2.5W	27	62	3	0.16
160527	20:35:12.91	44º44.24'	111º00.68'	7.0	0.7W	13	122	2	0.16
160527	20:35:41.24	44º44.19'	111º01.73'	8.4	1.0W	13	131	3	0.21
160527	20:42:41.43	44º44.41'	111º00.77'	8.8	1.8W	22	60	2	0.16
160527	22:26:54.39	44º43.99'	110º59.86'	7.1	0.5	12	136	3	0.07
160528	02:06:12.63	44º43.92'	111º01.46'	7.0	1.0W	16	75	3	0.17
160528	15:17:10.70	44º48.65'	111º00.08'	7.5	0.8W	16	173	6	0.11
160528	19:00:46.99	44º35.64'	110º44.85'	2.5	0.5	9	209	8	0.18
160528	22:01:31.84	44º34.68'	110º44.11'	8.5	0.9W	15	87	8	0.20
160528	23:31:20.35	44º35.13'	110º44.86'	4.9	0.8	6	221	9	0.08
160529	02:06:51.37	44º40.19'	111º02.39'	4.6	0.8W	10	92	6	0.12
160529	04:35:12.95	44º39.59'	111º03.13'	2.1	0.7W	7	120	7	0.03
160529	04:40:42.77	44º44.85'	110º46.75'	5.9	0.7W	9	165	7	0.08
160529	12:13:26.40	44º44.85'	111º13.73'	5.3	1.2W	16	109	3	0.19
160530	07:36:54.64	44º48.26'	110º48.97'	2.4	1.3W	19	107	3	0.20
160531	13:33:36.90	44º48.71'	111º00.17'	8.1	1.2W	15	125	6	0.13
160531	13:50:32.96	44º48.32'	111º00.36'	8.6	0.2	11	168	5	0.12
160531	17:16:07.00	44º48.72'	111º00.03'	7.6	0.1	10	175	6	0.11
160601	08:40:16.36	44º48.86'	110º59.82'	8.4	1.2W	23	177	6	0.16
160601	14:47:52.70	44º48.78'	110º59.84'	7.1	0.2	7	176	6	0.07
160602	15:24:45.93	44º48.74'	111º00.07'	8.7	1.0W	13	175	6	0.10
160603	00:35:40.35	44º48.63'	111º00.23'	7.8	0.1	12	173	6	0.08
160603	00:36:03.84	44º48.79'	110º59.92'	8.5	1.3W	17	176	6	0.12
160603	05:15:24.39	44º35.96'	110º22.14'	4.8	0.6	8	203	5	0.11
160603	23:11:45.24	44º47.87'	110º57.73'	6.4	0.9W	14	167	6	0.11
160604	02:54:03.34	44º51.45'	110º59.66'	8.6	0.3	13	214	11	0.11
160604	14:46:46.72	44º38.91'	110º02.03'	10.5	1.2	12	141	13	0.22
160604	16:42:18.54	44º38.79'	110º44.00'	5.6	1.0W	12	130	8	0.07
160607	00:16:51.62	44º41.63'	110º20.18'	15.7	1.2W	8	279	14	0.17

Table 2. Earthquakes in the Yellowstone Region: April 1–June 30, 2016

Date	Origin Time	Latitude	Longitude	Depth	Mag	No	Gap	Dmn	Rms
160607	04:18:23.28	44°27.24'	111°00.61'	5.6*	1.0W	11	188	24	0.11
160607	04:18:42.16	44°27.47'	111°00.00'	6.2*	1.4	5	217	22	0.06
160607	09:14:02.32	44°38.51'	110°00.25'	9.6	1.6	10	153	12	0.18
160608	00:19:58.75	44°48.28'	111°23.09'	10.6	0.8	10	183	16	0.10
160608	00:19:59.69	44°47.28'	111°19.44'	7.9	0.8	8	247	11	0.09
160609	02:19:29.05	44°45.54'	111°11.97'	11.0	0.1	10	156	1	0.18
160609	02:19:40.71	44°45.21'	111°11.33'	10.2	0.1	10	118	1	0.13
160610	12:29:23.19	44°33.01'	111°01.13'	13.6	0.3	6	139	9	0.09
160611	03:55:17.14	44°23.30'	110°59.60'	7.6	1.5W	15	124	14	0.12
160611	20:17:53.11	44°44.28'	111°07.38'	7.8	0.4	15	67	6	0.14
160612	01:18:50.55	44°44.54'	111°07.41'	9.1	0.3W	12	97	6	0.15
160612	17:31:52.99	44°06.52'	110°15.13'	10.8	2.0W	13	95	14	0.11
160613	21:58:42.12	44°22.33'	110°45.35'	2.2*	1.0	6	125	11	0.06
160613	21:59:00.48	44°22.07'	110°45.17'	1.9*	2.0	8	96	11	0.23
160614	13:13:04.96	44°45.30'	111°12.20'	7.0	0.0	9	86	1	0.09
160614	13:15:50.70	44°45.32'	111°12.20'	7.9	-0.1	9	86	1	0.05
160614	13:15:57.56	44°45.14'	111°12.43'	7.9	-0.7	6	108	1	0.05
160614	13:17:31.43	44°45.25'	111°12.31'	7.9	0.1	12	87	1	0.12
160614	21:47:44.34	44°45.21'	111°14.50'	8.4	0.6	7	136	4	0.06
160615	04:15:11.91	44°48.50'	110°48.00'	1.8	1.6W	16	126	5	0.11
160616	02:11:29.74	44°45.60'	111°04.49'	10.1	0.5	15	119	5	0.13
160616	07:41:13.86	44°46.50'	111°07.43'	8.5	0.5	18	59	3	0.15
160616	14:42:45.68	44°45.30'	111°11.43'	6.7	0.5	9	85	1	0.07
160617	01:20:34.73	44°48.63'	110°48.83'	3.6	1.4W	16	109	4	0.18
160617	05:07:13.62	44°48.48'	110°49.30'	4.2	1.0W	14	109	3	0.16
160618	11:49:00.64	44°50.23'	110°47.75'	3.2	1.0W	9	262	7	0.09
160619	00:22:52.02	44°14.93'	110°45.82'	9.9	2.1W	11	100	4	0.35
160619	10:46:35.42	44°46.52'	111°07.19'	9.7	1.4W	17	99	3	0.17
160620	06:06:44.21	44°47.57'	111°08.25'	10.8	0.9W	13	102	2	0.16
160620	09:00:37.25	44°49.10'	110°47.44'	3.1	0.7W	11	250	6	0.08
160620	12:23:26.86	44°46.40'	111°07.61'	6.7	0.4W	11	146	3	0.15
160621	05:20:14.47	44°47.43'	110°58.97'	5.1	0.7W	13	195	4	0.15
160621	18:10:44.03	44°45.95'	111°12.85'	12.1	0.3	9	246	2	0.19
160621	18:44:11.89	44°42.93'	111°07.59'	11.7	0.4	11	81	7	0.15
160623	10:18:46.73	44°33.49'	110°22.12'	2.5	1.3W	14	86	3	0.08
160623	10:21:31.74	44°33.40'	110°22.35'	2.5	1.0	11	120	2	0.09
160623	11:12:51.89	44°33.83'	110°22.41'	3.7	2.4W	19	68	2	0.11
160623	11:18:56.70	44°33.06'	110°22.29'	2.0	0.8	10	170	3	0.05
160623	11:21:39.86	44°33.55'	110°22.30'	2.9	1.0W	9	128	2	0.11
160623	11:25:08.78	44°33.73'	110°22.48'	3.5	1.9W	13	88	2	0.08
160623	11:25:52.45	44°33.18'	110°22.44'	2.2	0.3	8	148	2	0.08
160623	12:15:21.90	44°33.60'	110°23.16'	4.0	1.9W	12	87	1	0.13
160623	14:23:59.82	44°33.85'	110°22.78'	3.7	0.6	11	153	2	0.12
160625	02:06:56.66	44°46.99'	111°16.38'	15.8	1.5W	17	98	7	0.20
160625	15:30:03.45	44°10.12'	110°37.99'	11.2	1.1	11	129	11	0.13

Table 2. Earthquakes in the Yellowstone Region: April 1–June 30, 2016

Date	Origin Time	Latitude	Longitude	Depth	Mag	No	Gap	Dmn	Rms
160626	07:41:53.13	44º46.84'	110º59.11'	9.2	0.8W	17	148	3	0.15
160626	10:31:30.41	44º48.05'	110º58.85'	12.5	1.5W	21	125	5	0.20
160626	14:01:11.95	44º46.70'	110º59.07'	8.9	1.0W	17	145	3	0.16
160626	16:55:17.07	44º46.85'	110º58.75'	9.2	0.6W	13	149	3	0.19
160627	10:39:02.66	44º47.07'	110º59.05'	9.3	1.2W	15	151	3	0.17
160628	23:43:01.60	44º53.62'	111º29.17'	14.6	1.4W	10	150	8	0.14
160629	22:51:33.63	44º35.37'	110º22.58'	2.6	0.8	10	101	3	0.17
160629	22:57:28.14	44º34.15'	110º21.95'	2.0	0.9	9	92	3	0.14
160630	09:41:08.79	44º12.44'	110º46.61'	0.2	2.9W	23	96	7	0.23
160630	09:55:56.30	44º13.36'	110º47.24'	2.9	1.7W	20	90	6	0.23
160630	09:56:24.76	44º13.08'	110º46.83'	1.2	2.0W	16	93	6	0.28
160630	10:43:37.88	44º13.18'	110º46.58'	2.3	2.2W	22	93	6	0.20
160630	11:44:16.38	44º13.30'	110º44.07'	1.0	1.4	7	188	8	0.13
160630	12:31:25.89	44º13.79'	110º53.76'	2.4	1.0	6	194	9	0.30

number of earthquakes = 194
 * indicates poor depth control
W indicates Wood-Anderson data used for magnitude calculation

Table 3
UNIVERSITY OF UTAH YELLOWSTONE SEISMIC NETWORK
Operating Seismograph Stations
June 30, 2016

UURSN Code	Location	SEED Station	SEED Channel	No. of Channels	Network Code	Latitude	Longitude	Elevation (meters)	Sensor	Digitizer	Telemetry	Sponsor
B206*	Canyon206bwy2008, Yellowstone, WY	B206	EH[ZEN]	3	PB	44° 46.66′	110° 30.70′	2400	IESE-S2	Q330	Digital	PBO
B207*	Madisn207bwy2007, Yellowstone, WY	B207	EH[ZEN]	3	PB	44° 37.14′	110° 50.91′	2182	IESE-S2	Q330	Digital	PBO
B208*	Lakejn208bwy2008, Yellowstone, WY	B208	EH[ZEN]	3	PB	44° 33.61′	110° 24.09′	2406	IESE-S2	Q330	Digital	PBO
B944*	Grantt944bwy2008, Yellowstone, WY	B944	EH[ZEN]	3	PB	44° 23.38′	110° 32.63′	2365	IESE-S2	Q330	Digital	PBO
B945*	Panthr944swy2008, Yellowstone, WY	B945	EH[ZEN]	3	PB	44° 53.64′	110° 44.65′	2249	IESE-S2	Q330	Digital	PBO
B950*	Norris950bwy2013, Yellowstone, WY	B950	EH[ZEN]	3	PB	44° 42.77′	110° 40.71′	2328	IESE-S2	Q330	Digital	PBO
FLWY*	Flagg Ranch, WY	FLWY	BH[ZEN]	3	IW	44° 04.96′	110° 41.96′	2078	3ESP	RT-130	Digital	ANSS
H17A*	Grant Junction, Yellowstone, WY	H17A	BH[ZEN]	3	TA	44° 24.00′	110° 34.80′	2400	STS-2	Q330	Digital	NSF
IMW	Indian Meadows, WY	IMW	BH[ZEN]	3	IW	43° 53.58′	110° 56.58′	2670	3ESP	RT-130	Digital	ANSS
LKW*	Lake, WY	LKWY	BH[ZEN]	3	US	44° 33.91′	110° 24.00′	2424	STS-2	Q330	Digital	USGS
LOHW*	National Elk Refuge, WY	LOHW	BH[ZEN]	3	IW	43° 36.76′	110° 36.30′	2245	3ESP	RT-130	Digital	ANSS
MCID	Moose Creek, ID	MCID	EHZ	1	WY	44° 11.45′	111° 11.03′	2137	L4C	PSN	Analog	USGS
MOOW*	Moose Ponds, WY	MOOW	BH[ZEN]	3	IW	43° 44.92′	110° 44.69′	2128	3ESP	RT-130	Digital	ANSS
QLMZ*	Earthquake Lake, MT	QLMT	EHZ	1	MB	44° 49.84′	111° 25.80′	2064	L4C	-	Analog	MBMT
REDW*	Red-Top Meadows, WY	REDW	BH[ZEN]	3	IW	43° 21.74′	110° 51.18′	2322	3ESP	RT-130	Digital	ANSS
SNOW*	Snow King Mountain, WY	SNOW	BH[ZEN]	3	IW	43° 27.75′	110° 45.31′	2390	3ESP	RT-130	Digital	ANSS
TPAW*	Teton Pass, WY	TPAW	BH[ZEN]	3	IW	43° 29.41′	110° 57.04′	2512	3ESP	RT-130	Digital	ANSS
TPMZ*	Teepe Creek, MT	TPMT	EHZ	1	MB	44° 43.79′	111° 39.94′	2518	L4C	-	Analog	MBMT
YDC	Denny Creek, MT	YDC	EHZ	1	WY	44° 42.51′	111° 14.60′	2025	L4C	PSN	Analog	USGS
YFT	Old Faithful (YNP), WY	YFT	HH[ZEN]	3	WY	44° 27.05′	110° 50.24′	2292	Compact	Taurus	Digital	USGS
			EHZ	1					L4C	None	None	
YGC	Grayling Creek, MT	YGC	EHZ	1	WY	44° 47.77′	111° 06.45′	2075	L4C	PSN	Analog	USGS
YHB	Horse Butte, MT	YHB	EHZ	1	WY	44° 45.07′	111° 11.71′	2157	L4C	PSN	Analog	USGS
			HH[ZEN]	3					40T	ANSS-130	Digital	
			EN[ZEN]	3					Titan			
YHH	Holmes Hill (YNP), WY	YHH	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			

UURSN Code	Location	SEED Station	SEED Channel	No. of Channels	Network Code	Latitude	Longitude	Elevation (meters)	Sensor	Digitizer	Telemetry	Sponsor
YHL	Hebgen Lake, MT	YHL	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	YHR	HH[ZEN]	3	WY	44° 06.36′	110° 04.90′	2976	Trillium 120	Q330	Digital	USGS
YJCZ	Joseph's Coat (YNP), WY	YJC	EH[ZEN]	3	WY	44° 45.33′	110° 20.95′	2684	S13	PSN	Analog	USGS
YLAZ	Lake Butte (YNP), WY	YLA	EHZ	1	WY	44° 30.76′	110° 16.12′	2580	L4C	PSN	Analog	USGS
YLT	Little Thumb Creek (YNP), WY	YLT	EHZ	1	WY	44° 26.25′	110° 35.28′	2439	L4C	PSN	Analog	USGS
YMC	Maple Creek (YNP), WY	YMC	EH[ZEN]	3	WY	44° 45.53′	111° 00.41′	2073	S13	PSN	Analog	USGS
YML	Mary Lake (YNP), WY	YML	EH[ZEN]	3	WY	44° 36.20′	110° 38.63′	2653	L4C	PSN	Analog	USGS
YMP	Mirror Plateau (YNP), WY	YMP	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	YMR	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	YMS	EHZ	1	WY	44° 15.84′	110° 31.67′	3106	L4C	PSN	Analog	USGS
YMV	Mammoth Vault (YNP), WY	YMV	EHZ	1	WY	44° 58.42′	110° 41.33′	1829	L4C	PSN	Analog	USGS
YNE	Northeast Entrance (YNP), WY	YNE	HH[ZEN]	3	WY	45° 00.46′	110° 00.48′	2343	Compact	ANSS-130	Digital	USGS
YNM	Norris Museum (YNP), WY	YNM	HH[ZEN]	3	WY	44° 43.59′	110° 42.22′	2311	Trillium 240	Q330	Digital	USGS
YNR	Norris Junction (YNP), WY	YNR	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	YPC	EHZ	1	WY	44° 38.88′	110° 11.55′	2932	L4C	PSN	Analog	USGS
YPK	Parker Peak (YNP), WY	YPK	EH[ZEN]	3	WY	44° 43.91′	109° 55.32′	2897	L4C	PSN	Analog	USGS
YPM	Purple Mountain (YNP), WY	YPM	EHZ	1	WY	44° 39.43′	110° 52.12′	2582	L4C	PSN	Analog	USGS
YPP	Pitchstone Plateau (YNP), WY	YPP	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	YSB	EHZ	1	WY	44° 53.04′	110° 09.06′	2072	L4C	PSN	Analog	USGS
YTP	The Promontory (YNP), WY	YTP	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	YUF	HH[ZEN]	3	WY	44° 42.76′	110° 30.71′	2394	Compact	ANSS-130	Digital	USGS
			EN[ZEN]	3					Titan			
YWB	West Boundary (YNP), WY	YWB	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: 142 data channels from 45 stations were being recorded at the end of this report period

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:

<div align="center">

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

</div>

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)

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 APRIL 1-JUNE 30, 2016
 None