EARTHQUAKE ACTIVITY IN THE YELLOWSTONE REGION

Preliminary Epicenters

July 1 – September 30, 2015

Prepared by the University of Utah Seismograph Stations and funded by
the U.S. Geological Survey (Cooperative Agreement No. G13AC00018)

December 8, 2015

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, 2015

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During the three-month period July 1 through September 30, 2015, the University of Utah Seismograph Stations (UUSS) located 217 earthquakes within the Yellowstone region (Figure 1). The total includes 4 earthquakes in the magnitude 2 range. The largest event to occur during this period was a magnitude 2.2 earthquake on September 1st. No earthquakes were reported felt in the region (see Table 1, a cumulative tabulation of earthquakes that were felt in the Yellowstone region during 2015). 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://www.quake.utah.edu/EQCENTER/QUARTERLY/quarterly.htm*.

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 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 14 earthquakes ($0.2 \leq M \leq 1.9$) occurred about 10 miles SSE of West Yellowstone, MT on July 29th.
B. A swarm of 24 earthquakes ($0.0 \leq M \leq 1.5$) occurred about 7 miles SSE of West Thumb, YNP on September 4th.
C. A swarm of 10 earthquakes ($0.1 \leq M \leq 1.9$) occurred about 9 miles NE of Old Faithful, YNP on September 12th.
D. A swarm of 22 earthquakes ($-0.2 \leq M \leq 1.6$) occurred about 8 miles NNE of West Yellowstone, MT on September 25th - 26th.

These swarms are labeled in Figure 1.

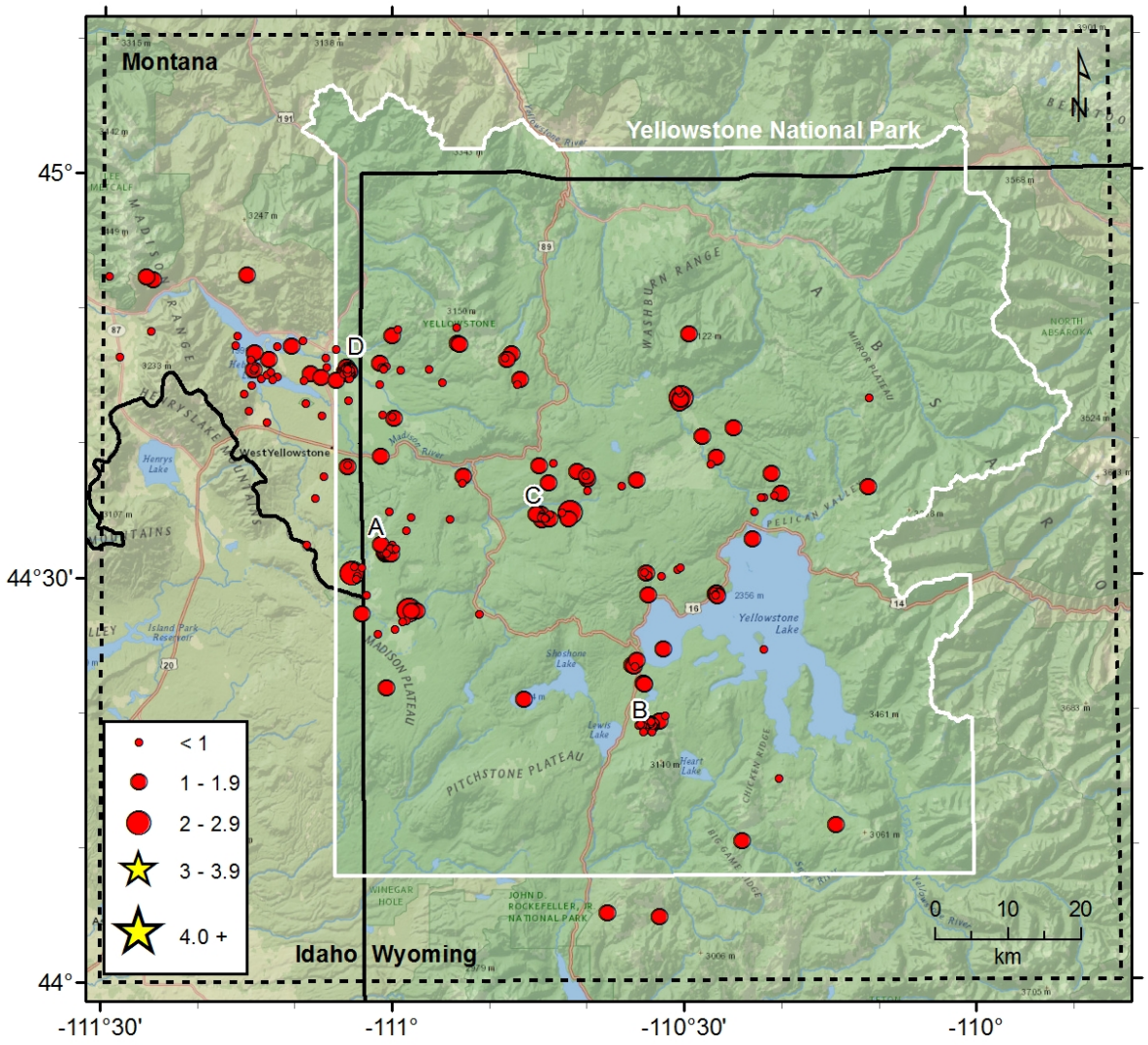

Figure 1. Earthquake epicenters located by the University of Utah Seismograph Stations, July 1, 2015 through September 30, 2015. Earthquakes of magnitude 3.0 and larger are depicted as yellow stars. Earthquake swarms labeled A-D are discussed in the text.

Table 1

EARTHQUAKES FELT IN THE YELLOWSTONE REGION
January 1, 2015 to September 30, 2015

Date	Time†	Felt Information‡	Latitude	Longitude	Magnitude§
May 18	17:00 MDT 23:00 UTC	Yellowstone. Felt (III) at Yellowstone National Park, WY.	44º 35.13′	110º 22.54′	M_L 3.0

† 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/archives.php), compiled by the U.S. Geological Survey (USGS); *ShakeMap* indicates the availability of computer-generated maps of ground-shaking (*http://www.seis.utah.edu/shake/archive*), 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/research/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, 2015

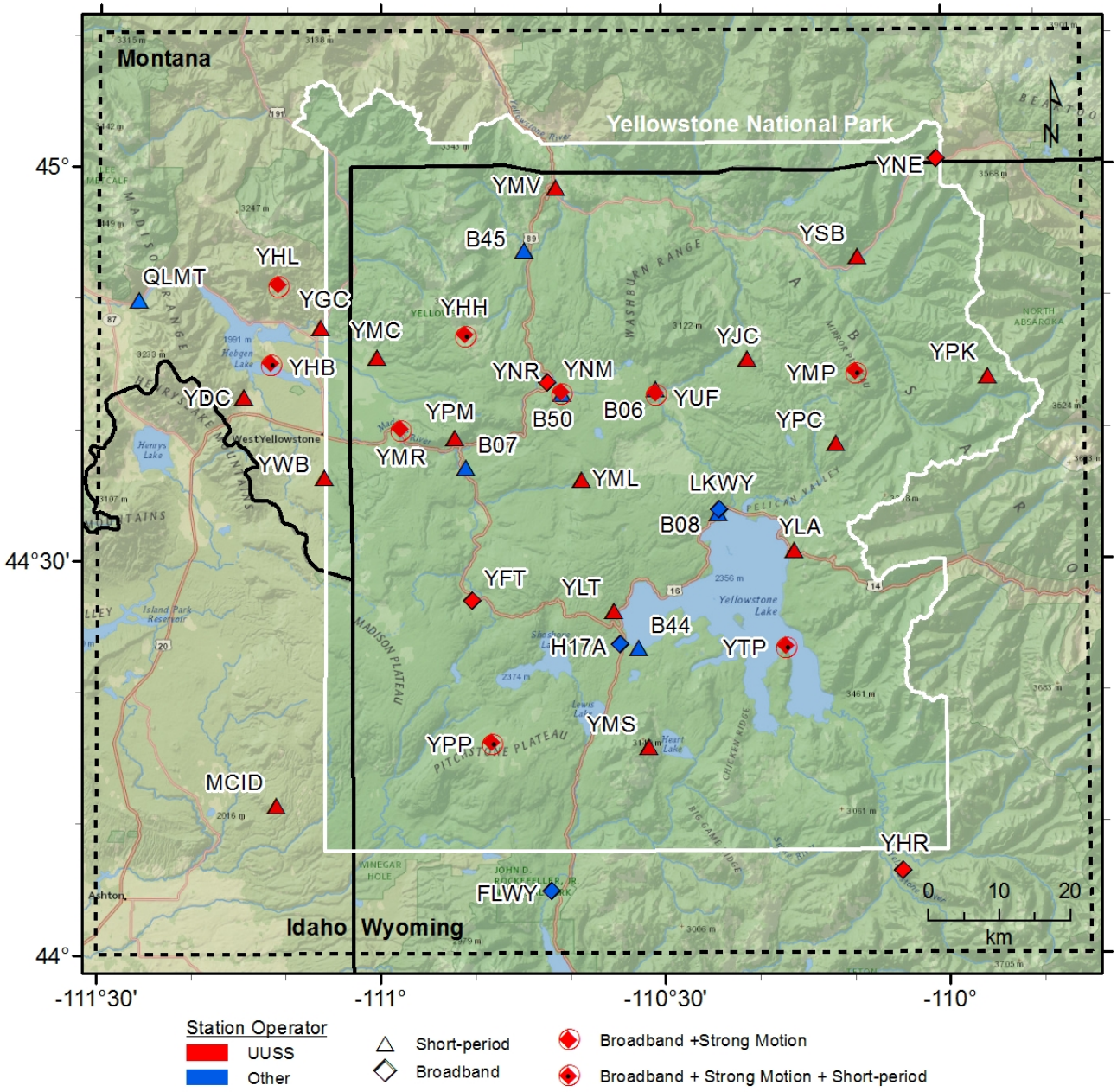

Figure 2

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2015

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
150701	18:28:03.63	44º47.21'	111º11.93'	15.0	0.6	8	156	4	0.17
150703	17:50:28.12	44º44.39'	111º01.32'	0.2	0.2	6	126	3	0.04
150703	23:24:28.02	44º46.36'	111º28.36'	11.7	0.7	8	134	7	0.05
150704	18:51:10.11	44º52.49'	111º15.11'	3.1*	1.5W	11	165	14	0.11
150705	00:18:56.11	44º34.37'	110º43.71'	2.2	1.9	6	156	8	0.11
150705	07:00:05.58	44º34.74'	110º43.65'	6.1	0.8W	13	146	7	0.06
150705	07:00:14.76	44º37.05'	110º43.76'	2.3	1.2	11	122	7	0.31
150705	10:47:02.50	44º45.17'	111º08.48'	14.7	1.5W	15	72	4	0.15
150706	12:43:14.17	44º44.89'	111º07.37'	12.0	1.1W	12	100	5	0.09
150706	22:56:00.35	44º47.64'	111º09.27'	8.9	0.0	11	165	4	0.26
150708	17:21:07.23	44º46.23'	110º48.08'	3.0	1.0W	14	101	4	0.16
150709	02:22:36.08	44º43.21'	111º04.50'	12.1	0.9W	13	117	7	0.12
150709	04:59:39.50	44º46.61'	110º47.61'	10.2	1.7W	16	74	5	0.25
150709	23:31:28.16	44º52.08'	111º24.90'	9.6	1.6W	18	111	4	0.23
150711	23:40:24.40	44º43.88'	110º30.22'	1.4	--	8	174	2	0.05
150711	23:41:38.31	44º42.94'	110º30.10'	1.7	1.8W	16	96	1	0.20
150712	00:03:03.23	44º43.73'	110º30.04'	1.6	0.7	11	233	2	0.19
150712	00:06:25.08	44º43.28'	110º30.04'	1.8	1.5W	14	146	1	0.16
150712	00:09:53.24	44º43.34'	110º29.94'	1.8	2.1W	22	100	1	0.14
150712	02:01:37.95	44º43.21'	110º30.04'	1.7	1.0W	16	154	1	0.18
150712	08:46:32.03	44º32.51'	111º08.83'	16.5	0.6W	11	141	20	0.11
150715	05:07:47.89	44º35.91'	110º21.73'	5.0	0.1	10	183	5	0.20
150715	06:22:48.20	44º35.89'	110º21.44'	1.5	0.2	11	185	5	0.21
150715	06:23:27.63	44º36.03'	110º20.39'	1.2	0.6	13	195	6	0.28
150717	22:19:53.25	44º43.67'	111º15.36'	18.4	0.2	7	163	2	0.09
150717	22:20:23.40	44º45.59'	111º14.30'	14.6	0.3	6	145	3	0.10
150718	00:46:13.42	44º45.43'	111º14.44'	13.4	0.4	8	128	4	0.08
150718	00:47:29.72	44º45.46'	111º14.38'	14.2	1.9W	22	121	4	0.16
150718	01:48:10.94	44º10.52'	110º23.91'	5.9*	1.4	17	175	14	0.19
150719	10:34:01.79	44º47.35'	110º52.95'	3.8	1.4W	15	123	3	0.12
150719	10:36:11.79	44º48.65'	110º53.32'	5.5	0.8W	10	160	4	0.11
150719	10:39:58.19	44º47.41'	110º53.22'	4.8	1.9W	21	120	3	0.14
150719	14:06:24.55	44º38.35'	110º44.78'	8.3	1.1W	10	141	8	0.10
150720	14:13:11.31	44º52.29'	111º25.56'	11.6	1.6W	21	119	5	0.21
150721	17:36:32.85	44º38.39'	110º26.92'	2.5	0.3	10	140	9	0.15
150721	19:11:15.61	44º23.49'	110º34.88'	2.1	0.8	7	109	1	0.03
150721	19:11:29.05	44º23.89'	110º34.69'	1.8	1.0	7	105	0	0.06
150721	19:11:49.29	44º23.55'	110º35.17'	2.3	1.8W	10	114	1	0.09
150721	19:13:13.09	44º23.46'	110º35.00'	1.9	1.7W	14	103	1	0.11
150721	19:46:14.68	44º39.08'	111º01.22'	9.9	1.1W	11	109	5	0.15
150723	07:03:59.80	44º41.57'	111º13.05'	5.3	0.8W	19	136	3	0.15
150724	18:52:59.24	44º44.42'	110º46.99'	4.1	0.7W	8	153	8	0.12
150724	18:55:21.16	44º44.73'	110º46.65'	4.3	1.0W	11	163	7	0.12
150726	11:21:19.35	44º48.49'	110º59.36'	7.7	0.9W	13	199	6	0.14
150727	02:36:21.39	44º45.43'	110º59.07'	9.8	0.8W	7	153	2	0.11

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2015

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
150728	00:31:24.65	44º27.58’	110º57.44’	8.6*	1.0	8	176	20	0.11
150729	06:06:28.77	44º04.90’	110º32.53’	10.9	1.2	19	101	13	0.13
150729	08:48:42.25	44º32.20’	111º00.24’	12.8	0.4	10	148	11	0.12
150729	08:53:05.46	44º32.50’	111º01.18’	14.3	1.1W	15	96	10	0.16
150729	08:53:24.39	44º32.07’	111º00.58’	12.9	1.7W	27	58	11	0.17
150729	08:55:15.78	44º32.19’	110º59.90’	14.4	0.8W	12	149	11	0.12
150729	08:56:42.49	44º31.87’	111º00.62’	13.7	1.6W	30	40	11	0.18
150729	09:01:35.51	44º31.79’	111º00.73’	12.9	1.8W	28	94	11	0.15
150729	09:14:15.92	44º31.95’	111º00.79’	15.0	1.9W	23	59	11	0.18
150729	09:27:28.12	44º31.84’	111º00.09’	12.2	1.1W	10	150	11	0.11
150729	09:28:28.97	44º31.98’	111º00.79’	14.2	1.7W	19	81	11	0.14
150729	09:51:25.81	44º32.49’	110º59.95’	13.6	0.9W	15	147	11	0.17
150729	09:51:38.26	44º34.53’	110º58.01’	11.9	-0.2	7	298	10	0.03
150729	09:56:09.16	44º32.30’	111º00.17’	14.2	0.7W	11	148	11	0.10
150729	10:05:45.97	44º32.25’	110º59.63’	13.7	0.2	13	151	11	0.18
150729	10:16:16.93	44º24.67’	110º21.51’	9.3	0.3	14	107	6	0.21
150729	10:29:21.35	44º31.87’	111º00.58’	11.5	0.4	9	149	11	0.07
150729	11:45:55.05	44º31.96’	111º00.37’	12.5	1.5W	21	116	11	0.16
150730	18:30:53.96	44º46.38’	111º06.87’	12.5	0.2	9	195	7	0.13
150730	19:07:29.39	44º45.67’	111º06.82’	11.5	0.4	12	80	4	0.17
150731	14:59:44.09	44º37.70’	110º20.63’	5.6	1.1	11	103	8	0.09
150801	02:27:58.17	44º41.08’	110º24.52’	3.3	1.2W	8	147	9	0.03
150801	09:27:43.25	44º42.04’	111º07.29’	7.9	0.2	7	92	9	0.05
150802	03:28:12.79	44º44.70’	111º05.80’	12.6	1.0W	12	102	6	0.12
150802	05:56:38.11	44º46.36’	110º48.22’	5.0	0.2W	7	186	4	0.05
150802	12:41:13.56	44º34.39’	110º53.99’	10.7	0.6	9	162	7	0.05
150803	14:58:50.20	44º42.39’	111º14.87’	6.6	0.2	9	266	1	0.15
150804	06:18:37.48	44º35.96’	111º07.96’	8.2	0.5	12	104	3	0.21
150805	03:41:49.21	44º46.24’	111º12.86’	15.3	1.3W	20	89	3	0.21
150805	13:55:57.29	44º46.24’	111º14.67’	15.7	0.1	14	92	4	0.19
150806	23:02:55.89	44º21.91’	111º00.63’	11.6	1.6	12	119	19	0.19
150808	00:25:50.24	44º11.63’	110º14.24’	10.0	1.5	16	132	16	0.16
150809	09:56:36.10	44º36.82’	110º36.18’	4.2	0.8W	15	93	3	0.14
150811	14:33:20.29	44º48.03’	110º29.10’	7.4	1.8W	24	97	9	0.22
150812	12:03:23.76	44º43.22’	110º10.38’	18.4	0.3	6	183	3	0.14
150812	22:09:56.60	44º37.54’	110º39.84’	5.2	1.4	20	92	3	0.16
150814	11:22:12.42	44º37.31’	110º39.73’	5.6	1.7W	30	72	2	0.15
150815	14:04:17.19	44º42.98’	111º08.94’	10.5	-0.1	9	82	5	0.08
150815	14:08:35.14	44º15.07’	110º20.08’	1.5*	0.3	10	224	16	0.19
150816	01:11:41.50	44º45.52’	111º00.92’	7.6	0.2	8	182	1	0.06
150816	02:35:11.26	44º36.60’	110º10.58’	2.2	1.3	7	194	4	0.10
150816	05:19:24.10	44º45.73’	111º00.62’	7.6	0.6W	12	183	0	0.15
150816	06:59:39.08	44º45.52’	110º56.19’	10.0	0.6W	12	153	6	0.09
150816	07:38:12.58	44º45.94’	111º01.24’	8.0	1.0W	18	142	1	0.12
150816	09:34:23.37	44º45.66’	111º01.04’	8.1	0.7W	14	170	1	0.08

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2015

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
150817	06:11:42.60	44º45.59’	111º00.92’	8.1	0.4	14	136	1	0.08
150820	09:34:23.49	44º32.83’	110º22.64’	4.6	1.9W	14	82	2	0.14
150821	07:45:44.68	44º28.80’	111º02.67’	16.1	0.7	10	144	15	0.06
150822	09:12:21.07	44º21.05’	110º46.42’	7.5	1.5W	21	76	9	0.15
150823	19:28:02.95	44º26.23’	110º59.67’	6.0*	0.4	6	150	23	0.06
150824	13:53:32.53	44º27.37’	111º03.13’	15.9	1.0	12	142	17	0.10
150824	18:38:41.00	44º37.90’	110º40.81’	3.8	1.8	10	134	4	0.09
150824	18:59:57.49	44º37.59’	110º39.92’	6.6	0.3	11	149	3	0.10
150826	19:59:30.65	44º28.71’	110º26.50’	3.6	--	6	130	10	0.09
150826	19:59:49.44	44º28.77’	110º26.53’	3.3	0.8	9	131	10	0.07
150826	20:04:31.47	44º29.02’	110º26.66’	2.6	0.9	11	135	9	0.13
150827	08:13:16.30	44º36.21’	110º19.66’	5.0	1.7W	21	90	7	0.13
150829	07:46:26.79	44º37.60’	110º52.59’	4.1	1.0W	15	56	2	0.20
150829	23:11:50.29	44º37.06’	110º52.75’	2.0	0.6W	7	102	2	0.08
150831	04:52:33.41	44º46.69’	111º14.28’	14.9	1.0W	26	81	4	0.22
150901	09:27:57.35	44º34.88’	110º41.54’	5.9	2.2	13	124	5	0.08
150901	09:28:10.95	44º34.40’	110º41.70’	5.1	1.7	8	200	5	0.06
150902	17:15:50.15	44º34.88’	110º22.44’	8.5	0.7	7	127	3	0.12
150904	08:26:39.38	44º18.65’	110º33.16’	7.7	0.6	11	92	6	0.20
150904	08:27:05.40	44º18.60’	110º34.00’	7.7	0.5	12	140	6	0.16
150904	08:38:20.41	44º18.98’	110º33.85’	6.2	0.8	9	139	6	0.12
150904	08:44:58.59	44º19.11’	110º33.55’	6.8	1.3W	23	88	7	0.17
150904	08:51:02.92	44º19.21’	110º33.56’	5.8	1.3W	22	88	7	0.14
150904	09:07:30.35	44º19.11’	110º34.58’	7.2	0.6	11	144	7	0.18
150904	09:11:01.75	44º19.16’	110º33.70’	6.4	0.5	20	87	7	0.16
150904	09:12:22.87	44º19.17’	110º33.63’	6.0	0.6	17	148	7	0.16
150904	09:12:35.72	44º19.20’	110º33.79’	5.8	0.8	17	91	7	0.18
150904	09:12:48.83	44º19.30’	110º32.87’	4.7	0.7	12	140	7	0.14
150904	09:13:21.51	44º19.80’	110º31.79’	2.2	0.0	8	108	7	0.17
150904	09:13:40.07	44º19.28’	110º33.28’	4.8	0.1	11	94	7	0.16
150904	09:13:55.88	44º19.34’	110º33.46’	5.4	0.8	16	89	7	0.14
150904	09:14:04.32	44º19.35’	110º33.21’	4.9	0.9	13	99	7	0.17
150904	09:14:32.36	44º19.38’	110º33.22’	4.8	0.0	9	94	7	0.13
150904	09:17:19.97	44º19.16’	110º33.68’	6.2	0.9W	21	87	7	0.15
150904	09:18:50.90	44º19.10’	110º33.05’	6.0	0.5	17	95	6	0.18
150904	09:21:31.01	44º19.15’	110º34.30’	8.0	0.3	15	145	7	0.25
150904	09:25:07.77	44º19.09’	110º33.30’	6.3	1.4W	22	91	6	0.16
150904	09:42:52.95	44º36.51’	110º39.72’	7.4	--	9	116	2	0.08
150904	10:13:37.67	44º19.19’	110º33.32’	6.3	1.2W	22	91	7	0.15
150904	10:26:34.52	44º19.14’	110º34.10’	6.7	0.5	11	141	7	0.12
150904	11:55:26.79	44º19.09’	110º33.52’	6.1	1.5W	16	88	6	0.12
150904	11:55:37.59	44º19.35’	110º32.42’	4.2	1.4	10	102	7	0.16
150904	13:00:55.00	44º18.75’	110º33.77’	7.4	0.9	18	92	6	0.13
150904	23:37:27.10	44º47.19’	111º10.43’	13.9	1.3W	15	98	4	0.22
150905	22:17:08.01	44º41.89’	110º59.82’	10.7	1.2W	14	56	4	0.08

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2015

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
150906	04:14:26.94	44º37.56’	111º07.08’	6.2	0.2	6	127	3	0.02
150908	04:39:30.33	44º25.92’	111º01.51’	2.4*	0.3	9	137	15	0.26
150908	14:10:46.74	44º27.40’	110º50.92’	6.5	0.6	11	120	1	0.15
150908	14:42:51.04	44º48.02’	110º59.99’	8.6	1.0W	15	164	5	0.12
150908	15:26:12.09	44º38.41’	111º04.66’	7.4	0.9W	13	102	4	0.11
150909	11:08:04.93	44º38.26’	111º04.59’	7.8	0.9	22	93	4	0.16
150909	15:24:33.86	44º44.68’	111º09.22’	12.2	0.4	12	89	3	0.17
150911	08:02:09.75	44º30.23’	110º33.51’	7.0	0.4	11	111	8	0.08
150911	08:02:22.46	44º30.40’	110º33.86’	2.2	0.2	13	107	8	0.16
150911	08:02:42.71	44º30.73’	110º30.15’	-1.3	0.4	10	158	10	0.09
150911	08:02:54.66	44º30.11’	110º32.10’	9.2	0.4	9	159	8	0.32
150911	08:03:47.84	44º30.36’	110º33.68’	5.9	1.0W	10	109	8	0.08
150911	16:09:53.29	44º41.98’	110º59.98’	6.9	0.8W	16	73	4	0.20
150912	02:49:24.09	44º34.46’	110º44.05’	3.7	0.8W	9	88	8	0.25
150912	03:04:50.15	44º34.86’	110º42.35’	13.3	0.9W	15	98	6	0.28
150912	03:07:01.18	44º34.53’	110º44.59’	3.9	0.6W	17	92	9	0.18
150912	03:09:20.62	44º34.74’	110º44.46’	7.5	0.8W	23	89	8	0.15
150912	03:13:20.25	44º34.51’	110º44.41’	6.9	0.7W	8	123	8	0.07
150912	03:18:39.73	44º34.72’	110º45.09’	5.8	1.0W	22	95	9	0.16
150912	03:31:12.74	44º34.75’	110º44.53’	8.3	1.3W	21	83	8	0.18
150912	04:53:44.35	44º34.47’	110º44.19’	6.0	0.1	8	125	8	0.11
150912	04:58:15.37	44º34.61’	110º44.48’	6.5	0.6W	19	90	8	0.20
150912	06:39:35.58	44º34.31’	110º44.47’	6.7	1.9	8	146	9	0.12
150913	01:38:19.33	44º52.33’	111º29.48’	14.4	0.4	15	153	7	0.11
150914	13:54:53.54	44º47.94’	111º16.11’	9.7	0.0	13	123	8	0.15
150915	01:16:00.84	44º30.82’	111º03.14’	13.5	0.8	17	129	11	0.18
150915	03:41:18.28	44º30.93’	111º03.94’	14.5	0.6	19	133	10	0.19
150915	12:10:54.52	44º30.42’	111º04.16’	15.8	2.0W	24	82	11	0.18
150915	12:37:32.92	44º30.02’	111º03.69’	6.0*	-0.1	8	172	19	0.14
150915	12:56:53.94	44º30.16’	111º03.68’	16.1	0.9W	16	143	12	0.26
150916	05:12:43.30	44º38.91’	110º26.35’	4.6	1.2W	16	131	9	0.16
150917	11:00:14.52	44º05.18’	110º37.90’	5.8	1.2	15	138	5	0.14
150917	12:30:22.26	44º26.91’	110º58.50’	4.3*	0.4	8	243	11	0.13
150917	12:34:34.98	44º26.84’	110º58.89’	4.3*	0.2	7	147	12	0.13
150917	20:20:53.23	44º34.96’	111º00.31’	11.5	0.5	14	90	8	0.26
150920	03:22:04.69	44º28.62’	110º26.31’	3.1	0.9	14	94	10	0.13
150920	03:23:48.15	44º28.87’	110º26.40’	3.4	1.0W	13	113	9	0.11
150920	03:36:07.16	44º30.65’	110º30.40’	18.0	0.8W	8	195	10	0.27
150920	03:39:57.52	44º28.75’	110º26.47’	2.9	1.2W	18	79	10	0.14
150921	01:12:32.16	44º38.52’	110º43.24’	7.8	0.3	11	133	7	0.13
150922	07:08:07.96	44º44.30’	111º14.64’	12.0	0.6	18	94	3	0.13
150922	08:31:44.98	44º40.47’	110º27.83’	3.7	1.2W	12	112	6	0.16
150922	15:08:12.37	44º44.57’	110º54.77’	4.8	0.6	9	120	7	0.09
150923	10:07:04.95	44º33.55’	110º58.57’	10.1	0.3	11	96	11	0.08
150923	17:28:14.03	44º27.57’	110º58.07’	4.2*	1.0	16	118	11	0.20

Table 2. Earthquakes in the Yellowstone Region: July 1–September 30, 2015

DATE	ORIGIN TIME	LATITUDE	LONGITUDE	DEPTH	MAG	NO	GAP	DMN	RMS
150923	17:28:53.20	44º27.66’	110º58.28’	3.9*	2.0W	26	113	11	0.17
150924	02:31:45.28	44º37.25’	110º34.60’	5.2	1.2	7	139	6	0.19
150925	00:20:19.42	44º44.96’	111º11.89’	12.1	0.2	16	80	0	0.13
150925	00:20:19.43	44º44.73’	111º12.44’	12.0	0.0	10	86	1	0.08
150925	03:42:19.14	44º45.33’	111º04.77’	10.5	0.1	13	115	6	0.09
150925	03:42:58.37	44º45.59’	111º04.59’	11.3	0.2	11	118	6	0.13
150925	03:52:46.06	44º45.44’	111º04.35’	11.3	0.1	13	118	5	0.12
150925	04:25:42.29	44º45.09’	111º04.75’	9.6	0.6W	17	100	5	0.18
150925	04:25:59.45	44º45.38’	111º04.64’	10.5	0.8W	16	171	6	0.19
150925	04:59:25.46	44º45.59’	111º04.79’	10.9	0.9W	16	176	6	0.17
150925	05:00:19.16	44º45.26’	111º04.65’	11.4	1.3W	19	104	5	0.13
150925	05:07:22.12	44º45.19’	111º05.01’	10.0	0.4	15	112	6	0.14
150925	05:08:02.92	44º45.43’	111º04.44’	9.4	0.8	14	117	5	0.14
150925	05:14:22.76	44º45.28’	111º04.55’	11.6	1.6W	18	105	5	0.17
150925	05:20:13.28	44º45.22’	111º04.24’	10.9	0.8W	15	107	5	0.16
150925	06:26:27.83	44º45.42’	111º04.55’	10.9	1.0W	16	117	6	0.14
150925	07:04:09.80	44º45.34’	111º04.85’	11.2	1.4W	17	102	5	0.15
150925	07:06:42.97	44º45.33’	111º04.49’	11.7	1.0W	18	106	5	0.16
150925	07:07:31.81	44º45.31’	111º04.97’	12.2	1.3	17	100	5	0.12
150925	07:07:42.11	44º45.65’	111º04.73’	12.9	1.2	14	109	5	0.12
150925	07:16:56.05	44º44.81’	111º04.48’	10.6	0.2	10	99	6	0.09
150925	07:22:44.16	44º44.84’	111º04.55’	10.4	0.6W	13	146	6	0.11
150925	07:57:35.91	44º45.21’	111º04.36’	11.1	0.5W	16	115	5	0.16
150925	08:03:38.12	44º45.55’	111º04.66’	10.3	-0.2	15	118	6	0.15
150925	09:13:06.65	44º45.16’	111º04.79’	11.4	1.0W	16	100	5	0.18
150926	03:17:38.80	44º47.03’	111º05.83’	9.4	-0.2	12	130	8	0.11
150926	18:54:29.17	44º48.29’	111º25.04’	11.1	0.3	7	122	3	0.07
150929	05:03:28.11	44º45.08’	111º13.01’	11.7	0.3	24	75	2	0.18
150929	05:03:28.20	44º44.82’	111º13.64’	11.0	0.5	10	107	2	0.10
150929	06:03:53.99	44º47.25’	111º16.33’	13.2	-0.1	15	129	7	0.11
150929	07:08:41.83	44º42.18’	111º00.96’	7.9	0.8W	20	61	6	0.13
150929	11:54:13.25	44º45.26’	111º04.61’	11.6	-0.1	14	116	6	0.12
150929	17:22:56.09	44º45.29’	111º12.64’	9.6	0.1	14	91	1	0.11
150930	12:21:50.06	44º28.73’	110º33.53’	3.4	1.5W	18	76	5	0.12
150930	12:35:49.04	44º24.75’	110º31.94’	0.8	1.2	5	139	5	0.05
150930	14:11:04.17	44º22.19’	110º33.99’	1.9	1.8	8	95	8	0.25
150930	14:14:41.99	44º22.16’	110º33.93’	1.5	1.8W	15	82	3	0.11

number of earthquakes = 217
* 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, 2015

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

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)

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, 2015

None