INL/EXT-14-33937

INL Seismic Monitoring Annual Report: January 1, 2012 – December 31, 2012

S. J. Payne, D. F. Bruhn , J. M. Hodges, and R. G. Berg

December 2014

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Idaho National Laboratory
Nuclear Safety and Engineering Programs/
Engineering Technical Authority
Idaho Falls, Idaho 83415

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SUMMARY

During 2012, the Idaho National Laboratory Seismic Monitoring Program evaluated 17,329 independent triggers that included earthquakes from around the world, the western United States, and local region of the Snake River Plain. Seismologists located 1,460 earthquakes and man-made blasts within and near the 161-km (or 100-mile) radius of the Idaho National Laboratory. Of these earthquakes, 16 had small-to-moderate size magnitudes (M) from 3.0 to 3.6. Within the 161-km radius, the majority of 695 earthquakes (M < 3.6) occurred in the active regions of the Basin and Range Provinces adjacent to the eastern Snake River Plain. Only 11 microearthquakes occurred within the Snake River Plain, four of which occurred in Craters of the Moon National Monument and Preserve. The earthquakes had magnitudes from 1.0 to 1.7 and occurred at deep depths (11-24 km). Two events with magnitudes less than 1.0 occurred within the Idaho National Laboratory boundaries and had depths less than 10 km.

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ACKNOWLEDGEMENTS

We thank Seth Carpenter (now at the University of Kentucky) for his assistance performing earthquake analysis during 2012. We also thank staff at the University of Utah Seismograph Stations, U. S. Geological Survey, and Montana Bureau of Mines and Geology for their earthworm data shares. We also appreciate the support of Incorporated Research Institutions in Seismology (IRIS). The research was funded by the Idaho National Laboratory through the U.S. Department of Energy Idaho Operations Office contract DE-AC07-05ID14517.

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ACRONYMS

ANL	Argonne National Laboratory
ATR	Advanced Test Reactor
CFA	Central Facilities Area
COM	Craters of the Moon National Monument and Preserve
DAAS	Data Acquisition/Analysis System
DOE	Department of Energy
DSL	Digital Subscriber Line
EFS	Experimental Field Station
ESRP	Eastern Snake River Plain
GPS	Global Positioning System
ICPP	Idaho Chemical Processing Plant
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IP	Internet Protocol
IRC	INL Research Center
LOFT	Loss of Fluid Test
MFC	Materials and Fuels Complex
Mw	Moment Magnitude
M_c	Coda Magnitude
M_L	Local Magnitude
M_s	Surface-wave Magnitude
NEIC	National Earthquake Information Center
NRF	Naval Reactor Facility
OFS	Old Fire Station

PBF	Power Burst Facility
PBO	Plate Boundary Observatory
P-wave	Compression Wave
REC	Research and Education Campus
RMS	Root Mean Square
RWMC	Radioactive and Waste Management Complex
S-wave	Shear Wave
SMC	Special Manufacturing Complex
SMA	Strong Motion Accelerograph
SSCs	Structures, Systems, and Components
TAN	Test Area North
TRA	Test Reactor Area
USGS	United States Geological Survey

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1. Introduction

The Idaho National Laboratory (INL) has accumulated 40 years of earthquake data (1972-2012). This report covers the earthquake activity from January 1, 2012 through December 31, 2012 and is a continuation of previous annual reports on earthquake activity surrounding the eastern Snake River Plain (ESRP) and within and near the INL. It discusses the earthquake activity that has occurred around the local region and within 161 km (or 100-miles) of the INL and centered at 43° 39.00' N, 112° 47.00' W (Figure 1). It discusses seismic station, strong-motion accelerograph (SMA), and continuous GPS (Global Positioning System) instrumentation used to record earthquake data and how the data are analyzed.

1.1 History of INL Seismic Monitoring Program

1.1.1 Purpose

The purpose of the INL Seismic Monitoring Program is to provide the INL with earthquake data and staff expertise to support the requirements set forth by Presidential executive orders, Department of Energy (DOE) directives, orders and standards, and the Nuclear Regulatory Commission for seismic safety of: Structures, Systems, and Components (SSCs); workers and the public; and operations at INL of reactors and waste management activities. The program supports safety of operations through continuous monitoring of earthquake activity, the development of INL seismic design criteria, assessments of seismic hazards for existing facilities and new facility siting, and early warning of potential future volcanic activity near INL. For example, the seismic monitoring is required by DOE Order 420.1C "Facility Safety" (DOE, 2012).

The INL Seismic Monitoring Program operates 27 permanent seismic stations for the purpose of determining the time, location, and size of earthquakes occurring in the vicinity of the INL. The seismic data are compiled to develop an historical database that defines the zones and frequency of earthquake activity. INL seismic stations of various network configurations have monitored earthquake activity since 1972 (Section A-1; Appendix). The current configuration includes seismic stations located within and around the INL near Quaternary normal faults and volcanic rift zones (Figure 1). Additionally, GPS receivers are co-located at 16 seismic stations for the purpose of determining rates of crustal deformation. GPS velocities are used to identify regions of higher crustal deformation rates (such as Yellowstone Caldera in Wyoming) relative to regions of lower deformation rates (e.g., Snake River Plain, Idaho).

The INL Seismic Monitoring Program currently operates 20 SMAs within and near facilities for the purpose of recording strong ground motions from local moderate or major earthquakes. Half of the SMAs are located within INL buildings to determine the response of these buildings to ground motions in the event of a large earthquake. The other SMAs are located at "free-field" sites (not within buildings) at INL facility areas and are used to determine the levels of earthquake ground motions at the ground (rock or soil) surface. SMAs or accelerometers are also co-located at seven INL seismic stations to record acceleration data and assess attenuation effects of small to large magnitude normal faulting earthquakes. SMAs were first installed in the 1970's and their facility locations have evolved based on the needs of facility operations (see Section A-2; Appendix A).

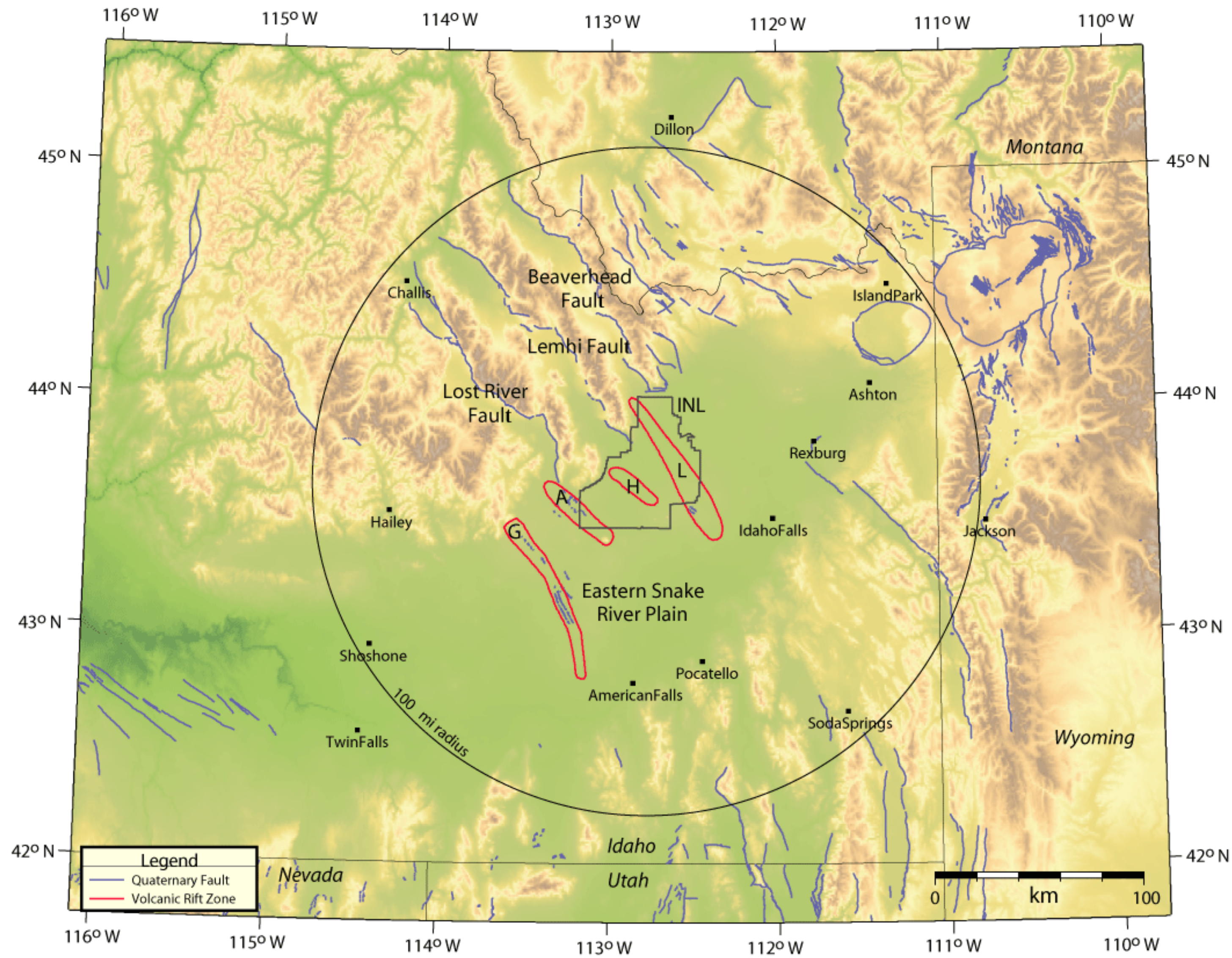

Figure 1. Map shows locations of the earthquake reporting area within a 161-km (100 mile) radius around the INL, Quaternary faults, and volcanic rift zones: G – Great Rift, A – Arco, H – Howe-East Butte, and L – Lava Ridge-Hell's Half Acre.

2. Instrumentation

2.1 Seismic Station Network

During 2012, the INL Seismic Monitoring Program operated 27 permanent seismic stations and monitored up to 50 seismic stations from other nearby seismic networks (Figure 2). Table 1 lists the name, location, and date of installation for the seismic stations owned and operated by the INL Seismic Monitoring Program. Table 2 lists the name, location, and operation dates of seismic stations owned by other agencies. The INL recorded seismic data from these other seismic stations to improve the quality of earthquake locations within the 161-km radius of INL.

Instrumentation for INL seismic stations consists of digital recorders, one- and three-component seismometers, and three-component accelerometers. The digital recorder is a DAQSystems NetDAS field unit, which is an embedded LINUX computer with a GPS clock and Symmetric Research 24 bit digitizer. The NetDAS units have from 22 to 24 bits of data resolution over ± 20 volts for a four-channel unit or ± 10 volts for an eight-channel unit. Four channel units (NetDAS-CH4) are located at seismic stations that have one or three sensors; eight channel units (NetDAS-CH8) are at seismic stations that have more than three sensors (such as three seismometers and three accelerometers). The NetDAS digitizes data at the seismic station and time stamps the data with accuracies of ± 0.001 seconds. The seismic signals are transmitted by FreeWave Technologies DGR115 900 MHz Wireless Modem radios. These radios use standard IP (Internet Protocol) networking features that are included in their embedded LINUX operating system.

The INL Seismic Monitoring program includes short-period and broadband seismometers and accelerometers (Table 1). Single-component short-period seismic stations have vertically oriented velocity sensors (or seismometers) that are a Mark Products model L-4C, Teledyne Geotech (TG) model S-13, or TG model S-13 Jr. seismometer. All seismic stations located within the ESRP have their vertical-component seismometer located at the bottom of 18-m or greater borehole to help dampen wind and cultural noise (Seismic, 1993). Seismometers at stations outside of the ESRP are buried within 3 m of the ground surface. Seismic stations with horizontally-oriented velocity sensors have two Teledyne Geotech model S-13 seismometers located within a concrete vault, in addition to the vertically-oriented sensor. Seismic stations with acceleration sensors have Applied MEMs Inc. model SF1500A, SF2500A, or SF3000L tri-axial accelerometers.

Two INL stations include three-component broadband seismometers, the New Production Reactor, Idaho (NPRI) and Crow's Nest Canyon, Idaho (CNCI) seismic station (Table 1). The INL acquired the broadband seismograph station I14A from the EarthScope project (Earthscope, 2007). The broadband sensor is co-located with the CNCI short-period seismic sensor. Instrumentation at CNCI includes a Quanterra Q330 data acquisition system and Guralp CMG-3T three-component broadband seismometer. The instrumentation remains in the original vault installed by USArray. The NPRI station was upgraded in 2011 to include broadband seismic monitoring capabilities as first step to upgrade additional INL seismic stations. The instrumentation at NPRI consists of a Quanterra Q330-SR data acquisition system and a three-component, Nanometrics Trillium T120-PA broadband seismometer. The instrumentation is housed within a vault-like enclosure covered by native soils to dampen wind noise and reduce temperature fluctuations.

Where AC power is not available, seismic stations are powered by batteries, solar panels, and at some locations, small wind generators. Radio frequency compatible antennas transmit and receive the seismic signals. Several seismic stations are used as relay stations to allow transmission of seismic signals to the INL Research Center (IRC) at the Research and Education Campus (REC) in Idaho Falls. The seismic data are relayed by digital radios or internet Digital Subscriber Line (DSL) links (Section A-4; Appendix A). The data are acquired through EARTHWORM software over the Internet (discussed in Section 2.5). In the "Seismic Lab" at the IRC, digital seismograms are continuously displayed on four computer monitors referred to as "Webicorders."

2.2 Strong Motion Accelerographs

The INL accelerograph network currently consists of 20 strong-motion accelerographs: 19 are at facilities at the INL Site and one is located in the IRC. There are one to three accelerographs at each INL Site facility area (Figure 3). Additionally, since 2008, INL has operated one SMA outside of the INL boundary co-located at the COMI seismic station. Table 3 lists the location and date of installation for each of the SMAs in operation. During 2012, earthquakes did not trigger SMAs located within INL facilities.

INL SMAs are DAQSystems NetDAS digital accelerographs that have Applied MEMS SiFlex SF2500 tri-axial accelerometers mounted within the unit. Each accelerometer component of an SMA is set to trigger and record to compact flash when ground motions exceed ~0.005 g except for the SMA in the basement of ATR (TRA2) which is set to ~0.0005 g. The record lengths are set for 30 s of pre- and post-trigger thresholds. The tri-axial accelerometers have two horizontal components oriented in an orthogonal manner, generally aligned in the north-south and east-west directions. Appendix B lists the accelerometer orientation and instrument response for the horizontal and vertical components of each SMA. SMAs at free-field sites have GPS clocks to synchronize the internal clocks to an absolute time system. For some SMAs at free-field sites and locations within buildings, acceleration data are transmitted to the IRC via digital radios or the Internet. Other SMAs record data on compact flash disks that are retrieved by INL seismic personnel using a laptop computer.

2.3 Continuous GPS Stations

The INL Seismic Monitoring Program has a geodetic network for the purpose of monitoring crustal deformation in support of INL seismic hazards assessments. The network consists of 16 GPS receivers and antennas co-located with INL seismic stations. As part of the Plate Boundary Observatory (PBO) under the EarthScope Science Program, there are currently 19 other continuous GPS sites near the Snake River Plain (Figure 4). One of these GPS receivers is co-located at INL's Great Rift, Idaho (GTRI) seismic station. In addition to continuously operating GPS sites, INL personnel collected GPS phase data at several campaign GPS sites.

An INL continuous GPS station consists of a Trimble NetRS GPS receiver connected to a Trimble L1/L2 dual frequency choke ring antenna. The antenna is attached to a 2.4 m steel rod that is drilled into a rock outcrop to a depth of about 1 m. The NetRS receivers continuously collect GPS phase data (positions of 20 satellites) at 30 seconds intervals. The phase data are relayed along with the seismic station data to DSL links, which are then accessed from the Internet at the IRC. Also, the phase data are downloaded daily from the Internet and archived by UNAVCO,™ a non-profit university-governed consortium.

During 2012, INL collected GPS phase data and teamed with Dr. Robert King at the Massachusetts Institute of Technology to process INL GPS phase data. Dr. King processed all of INL's GPS phase data acquired up to 2012 and located within the ESRP and surrounding Basin and Range. He combined the INL GPS data with other data in the region to produce a horizontal GPS velocity field that encompasses the Pacific Northwest.

GPS data are used to investigate active crustal deformation that is on the order of millimeters of movement per year within the ESRP, the surrounding Basin and Range, and Yellowstone Caldera. GPS data help distinguish regions of high velocity gradients (or strain rates) having more frequent damaging earthquakes (e.g., Yellowstone – Hebgen Lake, Montana) from regions of low velocity gradients (e.g., eastern Snake River Plain). The regional spatial patterns of GPS data also help constrain the fundamental geodynamic processes that drive active continental deformation in the western United States. Locally, the horizontal GPS velocities indicate the Basin and Range is rapidly extending at a rate greater than the very slowly deforming Snake River Plain, which is thought to explain its relative low seismicity (e.g., Payne et al. 2012; Payne et al., 2013).

2.4 Seismic Data Acquisition and Analysis System

The INL records earthquake data on a computer Data Acquisition/Analysis System (DAAS) at the IRC, which has evolved since 1991 (see Section A-3; Appendix A). The DAAS employs two major software packages: EARTHWORM, which is used to perform earthquake detection and recording; and SEISAN, which is used to analyze earthquakes (see Section 3). EARTHWORM performs two primary functions that include signal discrimination for possible earthquakes and data sharing with other seismic networks. Additionally, the DAAS has a dedicated computer (or Vault) that routinely backup files on the acquisition and analysis computers and archives all digital earthquake data after analysis.

EARTHWORM constantly monitors seismic signals from INL seismic stations by evaluating the amplitude ratios of the short-term average divided by the long-term average (STA/LTA). This involves comparing the short-term root-mean square (RMS) average (1-s window) of the seismic data to a longer-term RMS average, which is the background noise or voltage level determined over a time interval of 20 s. The program determines that an earthquake has occurred when the STA/LTA ratios for several stations exceed a threshold value. When an earthquake is detected, seismograms are saved in a file on a disk. This file is labeled with a sequential number based on the date and time of the trigger. The trigger files are entered into the SEISAN database and are available for analysis in SEISAN. Each seismogram has 30 s of pre-event data and 20 s of post-event data stored within the file. The pre- and post-event durations ensure the entire earthquake waveform is recorded. In some instances, earthquakes have low-amplitudes, emergent compression (P) waves with larger amplitude shear (S) waves. When this occurs the DAAS may trigger on the S-waves instead of the P-waves, thus, saving 30 s of pre-event time allows recording of the P-waves also.

The earthquake detection software is configured to trigger on earthquakes detected by several stations within a subnet. Subnets contain several stations that are likely to detect the same local earthquake. All INL seismic stations usually detect local earthquakes of magnitude 1.5. Subnets are specified for stations in close proximity to each other and their relationship to known seismic sources. For the ESRP though, a subnet was created for detection of small magnitude ($M < 0.5$) microearthquakes.

The EARTHWORM software also enables data sharing with other seismic networks in near real time over the Internet. The INL provides data from various seismic stations to the University of Utah, Montana Bureau of Mines and Geology, and National Earthquake Information Center (NEIC), which in return provide data to INL (Table 2). EARTHWORM triggers on and records seismic data from INL and these other agencies. Analyzing earthquake data from these other seismic stations in SEISAN, expands azimuth coverage of earthquakes resulting in reduced uncertainties of earthquake locations and magnitudes within the 161-km radius of INL.

Table 1. Seismic stations operated by INL.

Code	Station Name	Types of Sensors	Latitude North (º)	Longitude West (º)	Elevation (m)	Date Installed (Month/Year)
ARNI	Argonne North, Idaho	Borehole Vertical Seismometer; GPS Receiver	43.6667	112.6235	1533	09/1990
BCYI	Bear Canyon, Idaho	Vertical Seismometer; Three-component Accelerometers; GPS Receiver	44.3108	113.4052	2194	05/1992
CBTI	Cedar Butte, Idaho	Borehole Vertical Seismometer	43.3875	112.9115	1734	07/1986
COMI	Craters of the Moon, Idaho	Three-component Seismometers; Strong-Motion Accelerograph	43.4618	113.5938	1890	03/1992
CNCI	Crows Nest Canyon, Idaho	Vertical (Short-period) Seismometer; Three-component Broadband Seismometers	43.9283	113.4522	1914	05/1992
CRBI	Circular Butte, Idaho	Borehole Vertical Seismometer; GPS Receiver	43.8303	112.6345	1520	11/1987
ECRI	Eagle Creek, Idaho	Vertical Seismometer	43.0535	111.3705	2086	08/1994
EMI	Eightmile Canyon, Idaho	Vertical Seismometer; GPS Receiver	44.0742	112.9262	1963	04/1992
GBI	Big Grassy Butte, Idaho	Borehole Vertical Seismometer; GPS Receiver	43.9875	112.0633	1541	10/1981
GRRI	Grays Range, Idaho	Vertical Seismometer; Three-component Accelerometers; GPS Receiver	42.9380	111.4217	2207	08/1994
GTRI	Great Rift, Idaho	Borehole Vertical Seismometer; GPS Receiver[a]	43.2440	113.2410	1522	05/1992

Table 1. Continued.

Code	Station Name	Types of Sensors	Latitude North (º)	Longitude West (º)	Elevation (m)	Date Installed (Month/Year)
HHAI	Hell's Half Acre, Idaho	Borehole Vertical Seismometer	43.2950	112.3795	1371	06/1992
HPI	Howe Peak, Idaho	Vertical Seismometer; GPS Receiver	43.7113	113.0983	2597	10/1972
HWFI	Howe Fault, Idaho	Three-component Seismometers; Three-component Accelerometers; GPS Receiver	43.9257	113.0973	1743	10/1999
ICI	Italian Canyon, Idaho	Vertical Seismometer; GPS Receiver	44.3293	112.9412	2463	04/1992
IRCI	INL Research Center, Idaho	Low-gain Three-component Seismometers	43.5153	112.0333	1442	11/1988
JGI	Juniper Gulch, Idaho	Three-component Seismometers	44.0927	112.6768	1657	11/1979
KBI	Kettle Butte, Idaho	Borehole Vertical Seismometer	43.5907	112.3767	1678	05/1992
LJI	Lemhi Junction, Idaho	Vertical Seismometer	43.8208	112.8440	1643	05/1990
LLRI	Little Lost River, Idaho	Three-component Seismometers; GPS Receiver	43.7230	112.9330	1476	05/1990
NPRI	New Production Reactor, Idaho	Three-component Short-period & Broadband Seismometers; Three-component Accelerometers; GPS Receiver	43.5975	112.8272	1495	09/1990
PTI	Pocatello, Idaho	Vertical Seismometer; Three-component Accelerometers; GPS Receiver	42.8703	112.3702	1670	10/1984
PZCI	Patelzick Creek, Idaho	Vertical Seismometer; GPS Receiver	44.3410	112.3172	2073	12/1991

Table 1. Continued.

Code	Station Name	Types of Sensors	Latitude North (º)	Longitude West (º)	Elevation (m)	Date Installed (Month/Year)
SMBI	Sixmile Butte, Idaho	Borehole Vertical Seismometer	43.5022	113.2677	1716	05/1992
SPCI	Split Crater, Idaho	Three-component Seismometers; Three-component Accelerometers	43.4500	112.6370	1553	06/1992
TCSI	Telchick Spring, Idaho	Vertical Seismometer; GPS Receiver	43.6193	113.4783	1731	05/1992
TMI	Taylor Mountain, Idaho	Three-component Seismometers; GPS Receiver	43.3057	111.9182	2179	10/1972

a. - GPS instrumentation is owned by the Plate Boundary Observatory under the EarthScope Science Program.

Table 2. Agencies and stations from which INL receives data shares.

Code	Station Name	Latitude North (º)	Longitude West (º)	Elevation (m)
National Earthquake Information Center, Golden, Colorado				
AHID	Auburn, Idaho	42.7653	111.1003	1960
BMO	Baker City, Oregon	44.8525	117.3060	1154
BW06	Boulder, Wyoming	42.7667	109.5582	2224
DLMT	Dillon, MT	45.3625	-112.5964	1569
FLWY	Flagg Ranch, WY	44.0827	-110.6993	2078
FXWY	Fox Creek, WY	43.6381	-111.0268	2254
HLID	Hailey, Idaho	43.5625	114.4063	1498
IMW	Indian Meadows, Wyoming	43.8970	-110.9392	2646
LOHW	Long Hollow, Wyoming	43.6123	-110.6037	2121
MFID	Camas Ranch, Mayfield, ID	43.4151	-115.8278	1302
PLID	Pearl Lake, ID	45.0877	-116.0002	2164
REDW	Red Top Meadow, Wyoming	43.3642	-110.8518	2322
TPAW	Teton Pass, Wyoming	43.4902	-110.9507	2512
University of Utah, Salt Lake City, Utah				
BEI	Bear River Range, Idaho	42.1167	111.7823	1859
BMUT	Black Mountain, Utah	41.9582	111.2342	2243
H17A	Transportable Array Site	44.3951	-110.5762	2400
MCID	Moose Creek, Idaho	44.1903	111.1827	2149
MLI	Malad Range, Idaho	42.0268	112.1255	1896
NPI	North Pocatello, Idaho	42.1473	112.5183	1640
YMC	Maple Creek, Wyoming	44.7593	111.0062	2073
YPP	Pitchstone Plateau, Wyoming	44.2710	110.8045	2707
Montana Bureau of Mines and Geology, Butte, Montana				
MCMT	McKenzie Canyon, Montana	44.8277	112.8488	2323
MOMT	Monida, Montana	44.5933	112.3943	2220
TPMT	Teepee Creek, Montana	44.7298	111.6657	2518

Table 3. Strong-motion accelerographs operating in 2012.

Site Location[a]	Building Number[a]	Location	Site Code	Year Installed
MFC	ANL-767	Basement	EBR1	1973
MFC	ANL-768	Basement	FCF1	1973
CFA	CFA-1607	Free-field	CFA	1996
EFS	EFS	Free-field	PHFF	2010
COMI	NA	Free-field	COMF	2008
INTEC	CPP-666	Second Floor	FAS1	1984
INTEC	CPP-666	Second Basement	FAS2	1984
NRF	NRF-768	Free-field	NRFF	1996
NRF	NRF-A1W	First Floor	A1W	1983
NRF	NRF-S1W	First Floor	S1W	1983
PBF	NA	Free-field	PBFF	2005
PBF	NA	Free-field	ARAF	2005
ATR	TRA-602	Free-field	TRAF	2003
ATR	TRA-670	Basement	TRAB	1996
RWMC	NA	Free-field	RWMC	1997
RWMC	NA	Free-field	RWME	2005
REC	IF-602	First Floor	IRC	1983
TAN	NA	Free-field	TANA	2007
TAN	TAN-601	First Floor	TAN4	2008
TAN	SMC	First Floor	SMC	2007

NA – Not within a building.
a. Acronyms: ANL – Argonne National Laboratory; ATR – Advanced Test Reactor; CFA – Central Facilities Area; COMI – Craters of the Moon seismic station (Table 1); CPP – Chemical Processing Plant; EFS – Experimental Field Station; IF – Idaho Falls; INTEC – Idaho Nuclear Technology and Engineering Center; MFC – Materials and Fuels Complex; NRF – Naval Reactors Facility; PBF – Power Burst Facility; RWMC – Radioactive and Waste Management Complex; SMC – Special Manufacturing Complex; TAN – Test Area North; TRA – Test Reactor Area.

Table 4. Continuous GPS sites co-located with INL seismic stations.

Code	Station Name	Latitude North (º)	Longitude West (º)	Elevation (m)	Year Installed
ARNG	Argonne North, Idaho	43.6667	112.6235	1533	2005
BCYI	Bear Canyon, Idaho	44.3108	113.4052	2194	2003
CRBG	Circular Butte, Idaho	43.8303	112.6345	1520	2007[a]
EMIG	Eightmile Canyon, Idaho	44.0742	112.9262	1963	2005
GBIG	Big Grassy Butte, Idaho	43.9875	112.0633	1541	2007[a]
GRRG	Grays Range, Idaho	42.9380	111.4217	2207	2007[a]
GTRG	Great Rift, Idaho	43.2440	113.2410	1522	1998[b]
HPIG	Howe Peak, Idaho	43.7113	113.0983	2597	2005
HWFG	Howe Fault, Idaho	43.9257	113.0973	1743	2007[a]
ICIG	Italian Canyon, Idaho	44.3293	112.9412	2463	2007
LLRG	Little Lost River, Idaho	43.7230	112.9330	1476	2009
NPRG	New Production Reactor, Idaho	43.5975	112.8272	1495	2009
PTIG	Pocatello, Idaho	42.8703	112.3702	1670	2007[a]
PZCG	Patelzick Creek, Idaho	44.3410	112.3172	2073	2007[a]
TCSG	Telchick Spring, Idaho	43.6193	113.4783	1731	2005
TMIG	Taylor Mountain, Idaho	43.3057	111.9182	2179	2007[a]

a - Although hardware was installed for the GPS receiver in 2007, the receiver began acquiring phase data in 2008.

b - Co-located at INL's seismic station GTRI, but operated by the Plate Boundary Observatory under the EarthScope Science Program.

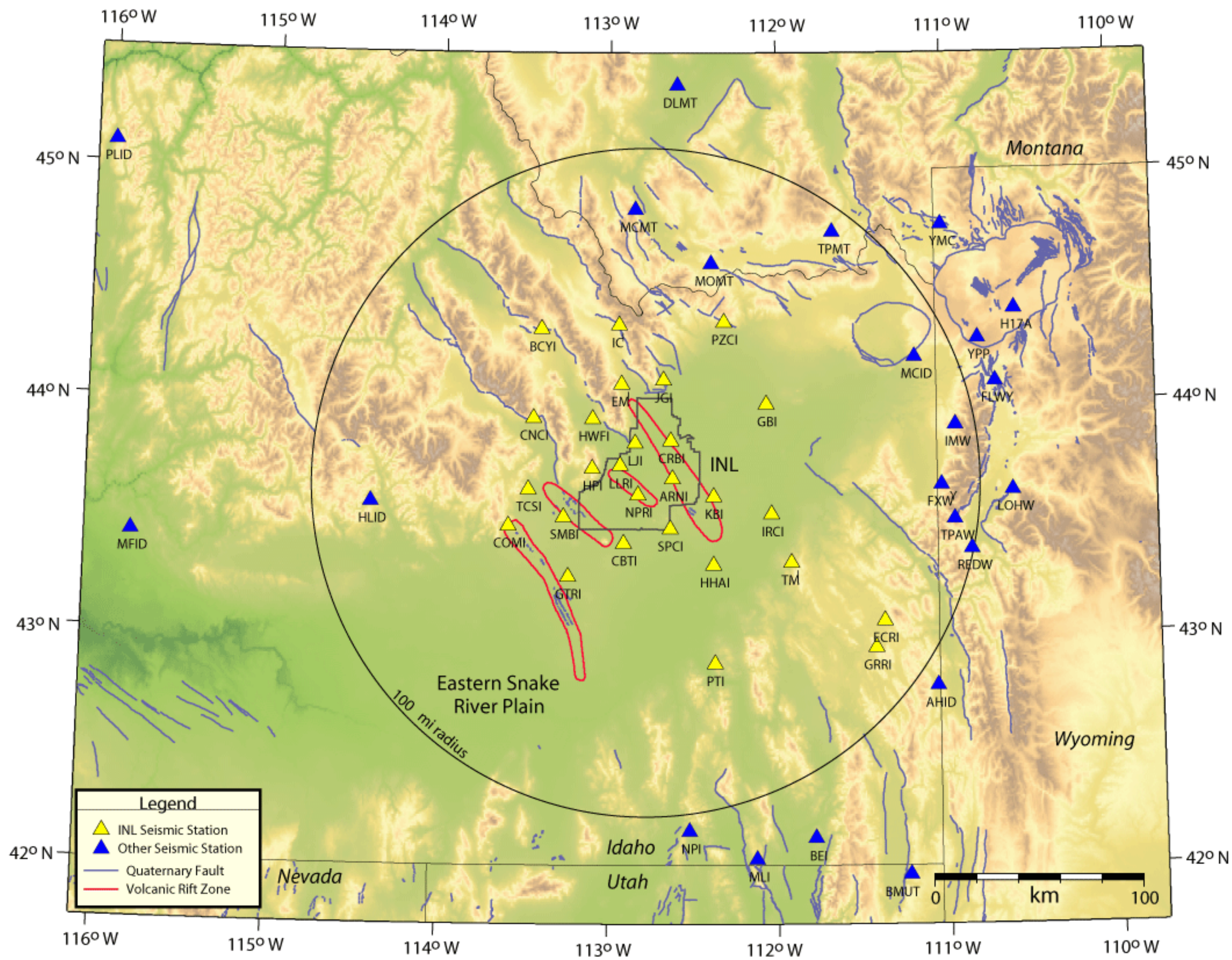

Figure 2. Map shows the locations of INL seismic stations and stations monitored by INL that are operated by other institutions. See Figure 1 for names of normal faults and volcanic rift zones. Stations BMO and BWO6 are not shown (see Table 2 for locations).

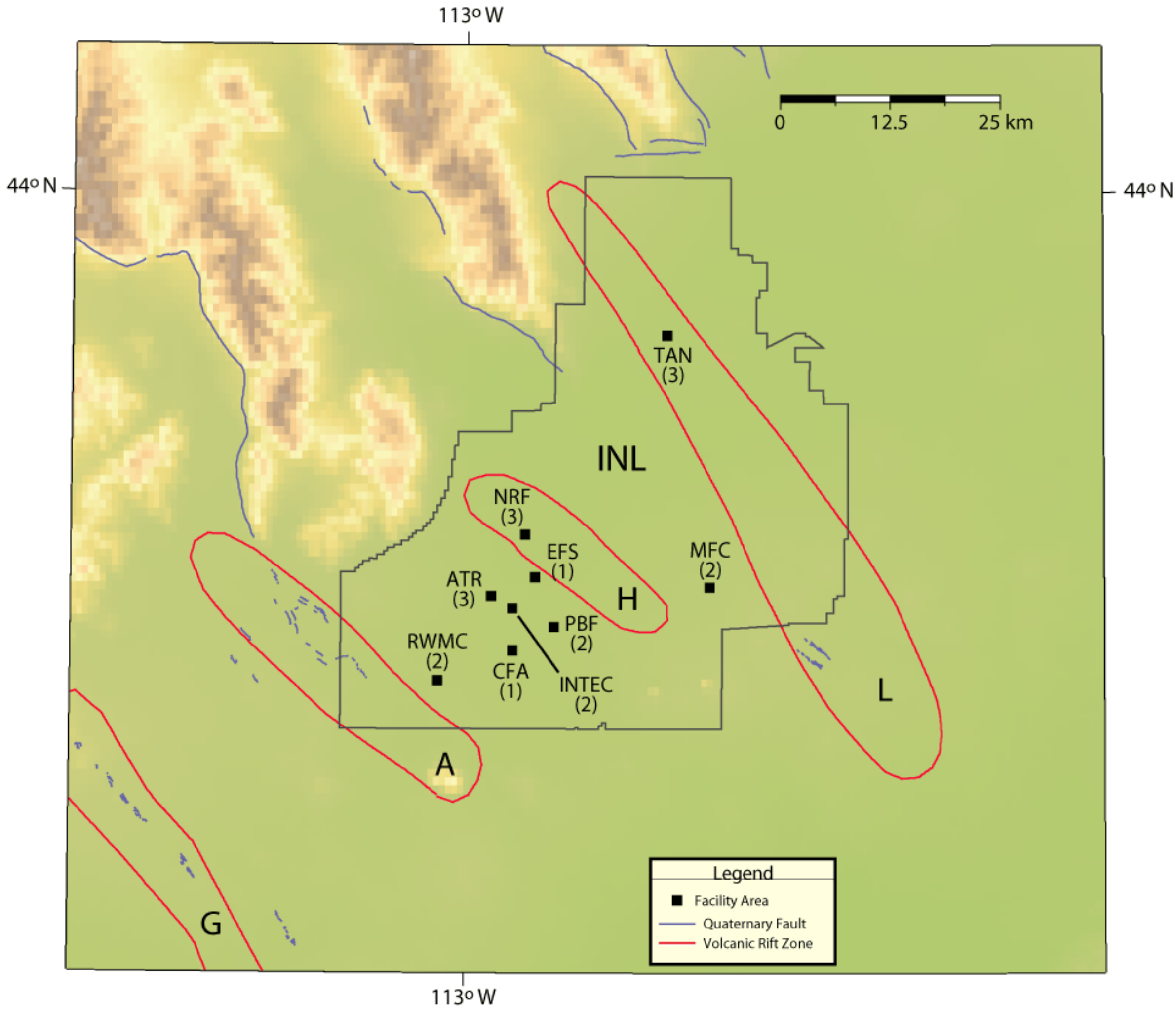

Figure 3. Map shows the number (in parentheses) of strong-motion accelerogaphs located at INL facility areas or other locations: Advanced Test Reactor (ATR), Central Facilities Area (CFA), Experimental Field Station (EFS), Idaho Nuclear Technology and Engineering Center (INTEC), Materials and Fuel Complex (MFC), Naval Reactors Facility (NRF), Radioactive Waste Management Complex (RWMC), and Test Area North (TAN). See Figure 1 for names of normal faults and abbreviations of volcanic rift zones.

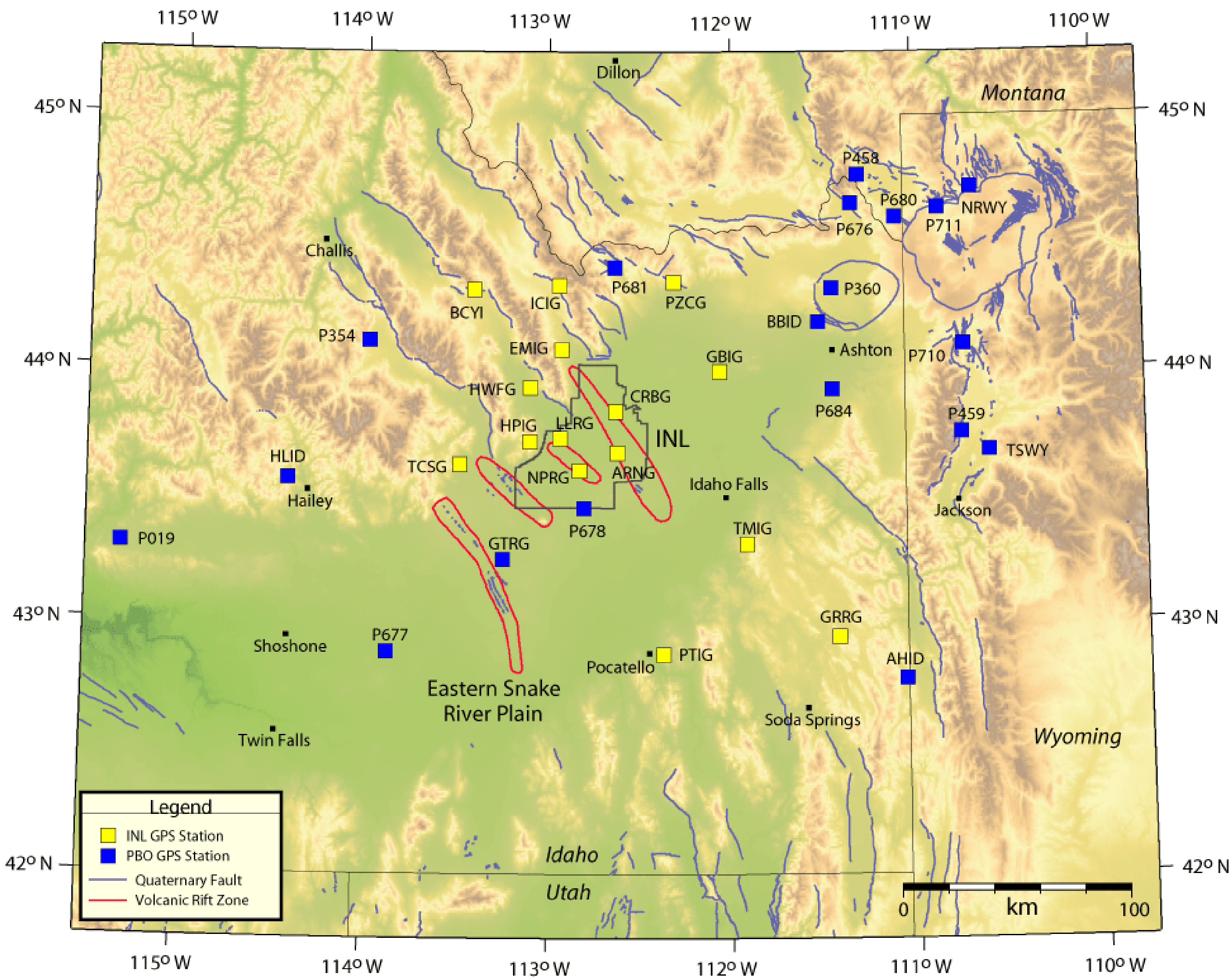

Figure 4. Map shows locations of continuous GPS stations co-located at INL seismic stations and those operated by the Plate Boundary Observatory (PBO) under the EarthScope Science Program. See Figure 1 for names of normal faults and volcanic rift zones.

3. Data Analysis

Digital seismograms are analyzed using the SEISAN program to determine the earthquake's location, magnitude, and peak ground accelerations. SEISAN displays multiple seismograms on a computer screen with corresponding time codes having accuracy of ± 0.001 s. P- and S-wave arrival times in the seismograms are selected at an accuracy of up to ± 0.01 s. Durations and amplitudes of seismic signals are selected and then used to calculate earthquake magnitudes. The arrival times, durations, and amplitudes measured for an earthquake are saved in a computer file directly from the SEISAN program. Instrument responses of the NetDAS units and sensors at seismic stations and SMAs are now routinely determined and are integrated into the SEISAN database (see Appendices B and C). Earthquakes are located using the HYPOINVERSE-2000 program and two methods may be used to calculate the final magnitude of an earthquake depending on its size. The locations and magnitudes of the earthquakes are plotted on maps to assess seismically active regions near the INL. When available from a large magnitude earthquake, amplitudes of accelerograms can be measured using the SEISAN program then processed using a separate program to determine peak horizontal and vertical accelerations.

3.1 Location Method

The HYPOINVERSE-2000 location program (Klein, 2002) is used to determine locations for all local earthquakes recorded. Phase data files (arrival times of the earthquake) from the output of SEISAN are input into the HYPOINVERSE-2000 program. Stable locations are usually obtained from about seven to ten arrival times (P- and S-waves combined) for recorded events that are not surrounded by INL seismic stations (Zollweg and Sprenke, 1995). Within the INL network, stable locations can be obtained with a minimum of six arrival times. Because of the density and sensitivity of the INL seismic network, the majority of earthquakes located within the 161-km radius have a minimum of six arrival times. However, some earthquakes are located with fewer than six arrival times and, thus, their locations are less accurate. Seismic stations from other agencies monitored by the INL provide coverage outside the INL network and phase arrivals from these stations supplement phase data from INL stations in an attempt to reduce location errors. Other notable parameters used in the HYPOINVERSE-2000 program are the starting focal depth, set to 5 km, and the distance cutoff for arrival weighting, set to 50 km.

Four P-wave velocity models are used in the HYPOINVERSE-2000 program depending on the location of the earthquakes (Table 5). The "ESRP" velocity model is used for locating earthquakes that occur within the ESRP and including the mountainous terrain along the Idaho-Wyoming border and southeast Idaho (Olsen et al., 1979; Sparlin et al., 1979; Braile and Smith, 1979; and Ackerman, 1979). The "INL ESRP" velocity model is used to locate earthquakes that occur on the ESRP and are near or within the INL Site boundaries. This model was developed from Sparlin et al. (1982) and Braile et al. (1982) and checked with respect to a few microearthquakes located within the ESRP (Jackson et al., 1989). The "BPEAK" velocity model is used for locating earthquakes that occur in the Borah Peak aftershock area and the mountainous terrain northwest of the Plain (Richins et al., 1987). Finally, the "SMT" velocity model is used to locate earthquake in southwestern Montana (Stickney, 1997). For all velocity models, a P-wave velocity to S-wave velocity ratio of 1.75 is used (Bones, 1978; Greensfelder and Kovach, 1982; and Richins et al., 1987).

3.2 Magnitude Calculations

In SEISAN, magnitudes are determined using two methods 1) coda magnitudes using signal duration of digital seismograms and 2) local magnitudes using amplitudes from digital seismograms. A coda magnitude (M_c) is calculated for an earthquake using several signal durations measured from the seismograms of different seismic stations. A local magnitude (M_L) is calculated using the largest peak-to-peak trace amplitude measured from digital waveforms and the Richter magnitude equation. If a magnitude cannot be determined for a local earthquake, then magnitudes determined by other seismic networks may be used including, for example, the University of Utah, Montana Bureau of Mines and Geology, NEIC, Boise State University, and the U.S. Bureau of Reclamation. The summary list of earthquakes in Appendix D lists the type of magnitude calculated and what institution reported the magnitude.

3.2.1 Coda Magnitudes

A coda magnitude is determined by measuring the duration of an earthquake's seismic waves as identified on a vertical component seismogram in SEISAN. In SEISAN when the P-wave arrival time is selected, the earthquake's signal duration can be automatically selected by SEISAN or manually selected by a seismologist at INL. The duration is measured at the start of the earthquake signature (P-wave arrival) to the end of the coda, where the signal fades into the background noise of the trace. The durations are measured for each station where the earthquake's signal can be clearly identified. The following expression from Arabasz et al. (1979) is used to calculate the coda magnitude for each seismic station's duration measured:

$$M_c = -3.13 + 2.74 \log \tau + 0.0012 \Delta \qquad [1]$$

Where:

τ = Total signal duration recorded at the station in seconds;

Δ = Epicentral distance from the station in km.

The final coda magnitude is determined from the mean of coda magnitudes calculated for each station. The HYPOINVERSE-2000 program uses Equation (1) to estimate the mean coda magnitude along with the location.

3.2.2 Local Magnitudes

A local magnitude is determined by measuring the amplitudes of a synthetic Wood-Anderson seismogram digitally for the horizontal components generated in SEISAN. SEISAN allows the seismologist to generate synthetic Wood-Anderson seismograms from shear waves recorded on the horizontal components of accelerometers and seismometers at INL seismic stations. SEISAN calculates synthetic Wood-Anderson seismograms at a magnification of 2800 using the instrument response information for accelerometers and seismometers contained in Appendix C.

For each horizontal component at a station and for multiple stations, the seismologist manually measure or allows SEISAN to automatically measure the largest peak-to-peak amplitude (or A) in millimeters from the synthetic Wood-Anderson seismogram. Once measured, the local magnitude is calculated for each component using the Richter magnitude scale. Richter (1958) defined the local magnitude scale from the following equation:

$$M_L = \text{Log } A - \text{Log } A_o \qquad [2]$$

Where:

A = Recorded maximum trace amplitude from the zero-line measured in millimeters on a standard, Wood-Anderson seismogram;

A_o = Maximum trace amplitude from the zero-line in millimeters for a selected standard earthquake.

The Richter magnitude scale was developed for a standard earthquake of magnitude 3.0 at 100 km for A_o = 0.001 mm and amplitude of 1.0 mm measured on the standard seismogram. Dr. Richter constructed a table of magnitudes based on distance and -Log A_o for maximum trace amplitudes recorded on the standard Wood-Anderson seismogram.

SEISAN has a program that uses equation [2] and measured amplitude of each synthetic Wood-Anderson horizontal seismogram to calculate local magnitude. SEISAN uses the distance of the seismic station from the earthquake's epicenter and one-half the peak-to-peak amplitude to determine local magnitude using Richter's table. Typically, the earthquake is located using the HYPOINVERSE-2000 program first to estimate distances from the epicenter to seismic stations, then amplitudes are measured.

3.3 Peak Accelerations

Peak horizontal and vertical accelerations are determined from accelerograms using the SEISAN program. SEISAN displays the horizontal and vertical accelerograms for some free-field SMAs located at the INL and accelerometers co-located with the seismic stations. The SEISAN program allows the user to correct the accelerograms by removing the instrument responses listed in Appendices B and C. A separate program is used to measure the largest zero-to-peak acceleration amplitude from the corrected acceleration time history.

3.4 Location and Depth Quality

Comparisons between earthquake locations determined by the INL and locations determined by other temporary networks or NEIC have been used to approximate locations errors of earthquake epicenters (Jackson et al., 1993a). This method is very general and yields an approximation of the quality of the INL earthquake locations. Zollweg and Sprenke (1995) evaluated the parameters chosen for the HYPOINVERSE-2000 program used by INL and the locations produced for the INL station geometry. They determined that the parameters chosen yield good location results despite the poor coverage in azimuth of earthquakes outside the network. An evaluation of the difference between actual and computed locations showed that HYPOINVERSE-2000 location error was less than 0.25 km for test events located by the INL seismic stations. A more detailed discussion of location uncertainty is in Section A-5 (Appendix A).

The HYPOINVERSE-2000 location program also calculates depth to the hypocenter. Focal depths calculated by this program are not accurate for many of the earthquakes recorded by the INL seismic network for two reasons: 1) the station spacing is usually greater than twice the focal depth of the earthquake recorded; and 2) the earthquake usually occurs outside of the network. To calculate accurate focal depths, the earthquake ideally should occur within the seismic network and at a distance equal to or less than it's focal depth, and/or have S-arrivals from one or more stations within a distance of 1.4 focal depths of the epicenter (Gomberg et al., 1990). Although focal depths are listed in Appendix D, they should be interpreted within the context of the limitations discussed in this section unless otherwise discussed in another section about specific earthquakes.

3.5 Data Completeness

Local earthquakes are easily discriminated from other seismic data such as local mine blasts, air blasts (or sonic booms), and distant (worldwide) and regional earthquakes occurring far outside of the INL seismic network. For example, man-made blasts are easily discriminated from earthquakes on the basis of waveform characteristics, the time the event occurred, and the location and depth of the event. The NEIC earthquake website lists are regularly inspected to confirm consistency with the INL earthquake catalog for magnitudes 2.5 and greater. Typically, local mine operators provide lists of blasting times when requested by INL seismologists.

Detection threshold can provide a measure of completeness for the INL earthquake catalog. It is defined as the magnitude level at which the seismic network will nearly always detect and locate an earthquake. Zollweg and Sprenke (1995) evaluated the detection threshold of the INL seismic network by plotting the cumulative number of earthquakes as a function of magnitude to determine the lowest magnitude point that the curve begins to flatten. Zollweg and Sprenke (1995) determined the detection threshold to be a magnitude 1.3, anywhere within a 161-km (100-mile) radius around INL. Their conclusion was based on a plot of 1360 earthquakes for an 18-month period. Since the seismic stations are all located within 90 km of the center of INL, they suggested that the detection threshold is magnitude 0.8 within the network on the ESRP. The analysis of Zollweg and Sprenke (1995) suggests that the INL earthquake catalog is complete for magnitudes above 1.3 within a 161-km (100-mile) radius of INL and may be complete for magnitudes as low as 0.8 within the network. Ongoing hardware and software upgrades of INL seismic instrumentation and for the current DAAS have increased detection sensitivities to nearly magnitude 0.0, which allow recording of small magnitude microearthquakes within ESRP.

Table 5. P-wave velocity models used in location programs.

Velocity Model Code	Velocity (km/sec)	Depth to Top of Layer (km)	Layer Thickness (km)	References
ESRP	4.90	0.00	2.00	Olsen et al., 1979; Sparlin et al., 1979; Braile & Smith, 1979; Ackerman, 1979.
	6.00	2.00	15.00	
	6.70	17.00	23.00	
	7.90	40.00	Half-space	
INL ESRP	3.30	0.00	1.00	Sparlin et al., 1982; Braile et al., 1982; Jackson et al., 1989.
	4.90	1.00	2.00	
	5.30	3.00	2.00	
	6.15	5.00	2.00	
	6.53	7.00	10.00	
	6.80	17.00	23.00	
	8.00	40.00	Half-space	
BPEAK	4.75	0.00	1.64	Richins et al., 1987.
	5.59	1.64	5.31	
	6.16	6.95	11.05	
	6.80	18.00	22.00	
	8.00	40.00	Half-space	
SMT	5.52	0.00	5.86	Stickney, 1997.
	6.12	5.86	12.78	
	6.74	18.64	20.05	
	8.00	38.69	Half-space	

4. 2012 Earthquake Activity

During 2012, INL recorded 17,329 independent triggers from earthquakes and blasts that occurred in the local region, in the western United States, and worldwide. Within the local region, INL located 1,460 earthquakes and man-made blasts outside and within a 161-km (or 100-mile) radius of INL. Near and within the 161-km radius of INL, 16 earthquakes had small to moderate size magnitudes (M) from 3.0 to 3.6. Of the 695 earthquakes that occurred within the 161-km radius of INL, 11 occurred within the ESRP.

4.1 Regional Earthquake Activity

Fourteen earthquakes of M≥3.0 earthquakes occurred outside of the 161-km radius around INL in central Idaho, southern Montana, western Wyoming, southeastern Idaho, and northern Utah (Figure 5). Three events occurred in central Idaho. On August 15, 2012, an M_L 3.0 earthquake occurred southeast of Stanley, Idaho. Two earthquakes of M_c 3.0 and M_c 3.1 occurred on July 25, 2012 and August 26, 2012, respectively, west of Challis, Idaho. None of these earthquakes were reported as felt by local residents. One event occurred near Dillon, Montana (Figure 5): on September 5, 2012, an earthquake of M_L 3.3 occurred and was felt by local residents (Section A-6; Appendix A).

Throughout 2012, the majority of earthquakes having magnitudes >3.0 were scattered along the Idaho-Wyoming border (Figure 5). Five earthquakes of magnitudes from 3.0 to 3.5 occurred near the Yellowstone Caldera. Three of these events occurred on October 15, 2012 within 2 hrs of each other. They were all located in the same vicinity on the Idaho-Wyoming border southeast of Island Park, Idaho (Figure 5). The magnitudes included one M_L 3.1 and two M_L 3.0 events, none of which were felt by local residents. Two other larger magnitude earthquakes, M_L 3.2 and M_L 3.5, occurred on August 7, 2012 and September 5, 2012, respectively. These two events were located northeast of Island Park near Hebgen Lake, Montana (Figure 5), and both were felt by local residents (Section A-6; Appendix A).

Farther south along the Idaho-Wyoming border, four earthquakes occurred near Afton, Wyoming outside the 161-km radius of INL. Two earthquakes of M_L 3.0 on January 8, 2012 and moment magnitude (Mw) 3.6 on May 10, 2012 were located northeast of Afton in Wyoming (Figure 5). Neither event was reported felt by local residents. The other two earthquakes, an M_L 3.0 and M_L 3.4, were located southeast of Afton. The M_L 3.0 event occurred on February 28, 2012 and was not reported felt by local residents. The M_L 3.4 event occurred on January 5, 2012 and was reported felt by local residents (Section A-6; Appendix A). Near the Utah-Idaho border south of Malad City, Idaho in northern Utah, one earthquake of M_L 3.5 occurred on July 13, 2012 and was also reported felt by local residents (Section A-6; Appendix A).

4.2 Earthquake Activity within 161-km Radius of INL

During 2012, 695 earthquakes occurred within 161-km radius of INL; two of these earthquakes exceeded M 3. Earthquakes occurred in southeastern Idaho, along the Idaho-Wyoming border near Jackson, Wyoming, near Island Park, Idaho, in southwestern Montana, northwest of the INL, and within the ESRP (Figure 6). The two largest magnitude earthquakes, M_c 3.0 on March 9, 2012 and M_L 3.2 on April 4, 2012, were located northeast of Soda Springs, Idaho (Figure 5). Neither event was felt by local residents. Although 161 earthquakes occurred in the vicinity of the M_c 3.0 and M_L 3.2 events, they do not appear to be related to swarm activity or to either event. 216 small magnitude earthquakes occurred west of Jackson, Wyoming along the Idaho-Wyoming border. A small swarm of 39 earthquakes occurred from April to July near Driggs with four of the largest magnitudes including M_c 2.0-2.5 earthquakes. Although only seven earthquakes are shown in Figure 5 at the Idaho-Wyoming border near Island Park, Idaho, 100's of earthquakes occurred to the west in the Yellowstone Caldera.

156 earthquakes were located along the Idaho-Montana border (Figure 5). Although some events appear in clusters in southern Montana, very few are associated with swarm activity. Thirteen earthquakes have magnitudes from M_c 2.0 to 2.8, which are located in southern Montana and just over the border in Idaho. Further west in central Idaho, earthquakes occurred near Challis, Idaho and Stanley, Idaho. Earthquakes in Figure 5 show clusters of epicenters near Challis and to the southeast of the Challis. A small cluster of earthquakes are shown south of Stanley. Other earthquakes are scattered over the region located northeast and south of Challis. Nineteen of the 105 events in this region have magnitudes from M_c 2.0 to 2.6.

4.3 Earthquakes within the Eastern Snake River Plain

Eleven microearthquakes were located within the ESRP during 2012 (Figure 6). A microearthquake of M_c 1.3 occurred on January 2, 2012 and was located near the eastern physiographic boundary of the ESRP northeast of Pocatello, Idaho. Four microearthquakes were located west of Idaho Falls. The first event of M_c 1.4 occurred on July 31, 2012 and three other events of $M_L \leq 1.0$ occurred on August 4, 2012 within 30 minutes of each other. All events occurred between 11.5 and 12.9 km depth, and their waveforms appear tectonic in character. Two earthquakes were located with in the INL boundary near locations where events have been detected historically. The first event of M_L 0.3 is located near the western boundary of INL. It occurred on August 17, 2012 and has a focal depth of 9.6 km. The second event of M_L 0.5 is located near the southeast boundary of INL. It occurred on October 8, 2012 and has a focal depth of 2.4 km. The waveforms of each event appear tectonic in character.

Four microearthquakes occurred near the northern end of the Great Rift volcanic rift zone, which includes Craters of the Moon National Monument and Preserve (COM) (Figure 6). All of the events are located within and near the boundary of the COM (Figure 7). The first event of M_L 1.6 occurred on February 2, 2012. A second event of M_L 1.6 occurred on July 28, 2012. The third and fourth events of M_L 1.0 and M_L 1.7 occurred on September 22, 2012. These two events were the only ones that could be located since they occurred during 3 minute multiple-event sequence of four or five events. Three of the events have uncharacteristic deep depths of 20.5, 21.5, and 24.0 km (Figure 7). Their waveforms, particularly for the multiple events, have low-frequency characteristics suggesting the events may be volcanic related. They are a continuation of the on-going, low-rate micro-seismicity at COM that began in 2007 (Carpenter and Payne, 2009).

5. 1972 – 2012 Earthquake Activity

The earthquakes in 2012 were located in areas around and within the ESRP that have been active in previous years. Figure 8 shows that the majority of 2012 earthquakes occur in the Basin and Range Province regions surrounding the ESRP. Even though 81 microearthquakes ($M \leq 2.2$) have occurred within the ESRP, monitoring by the INL seismic network indicates that at present the ESRP is relatively seismically inactive when compared to surrounding Basin and Range Province (see also Jackson et al., 1993b). Ongoing activity of 29 events (2007-2012) within and near the Great Rift suggests possible association with volcanic processes. Nearly 2,200 years ago, the entire 80-km length of the Great Rift was volcanically active (Kuntz et al., 2002).

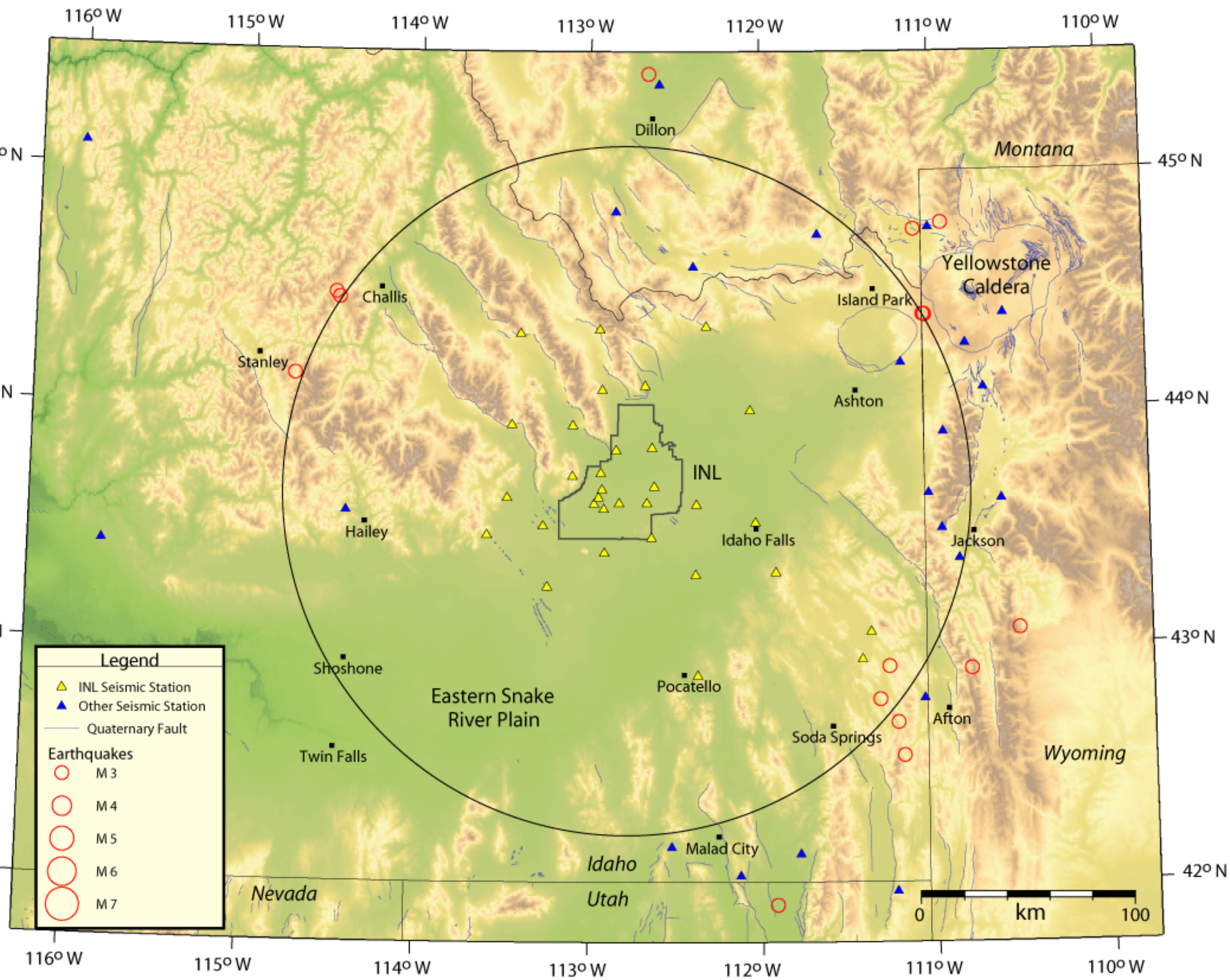

Figure 5. Map of epicenters of earthquakes for magnitudes greater than 3.0 during 2012.

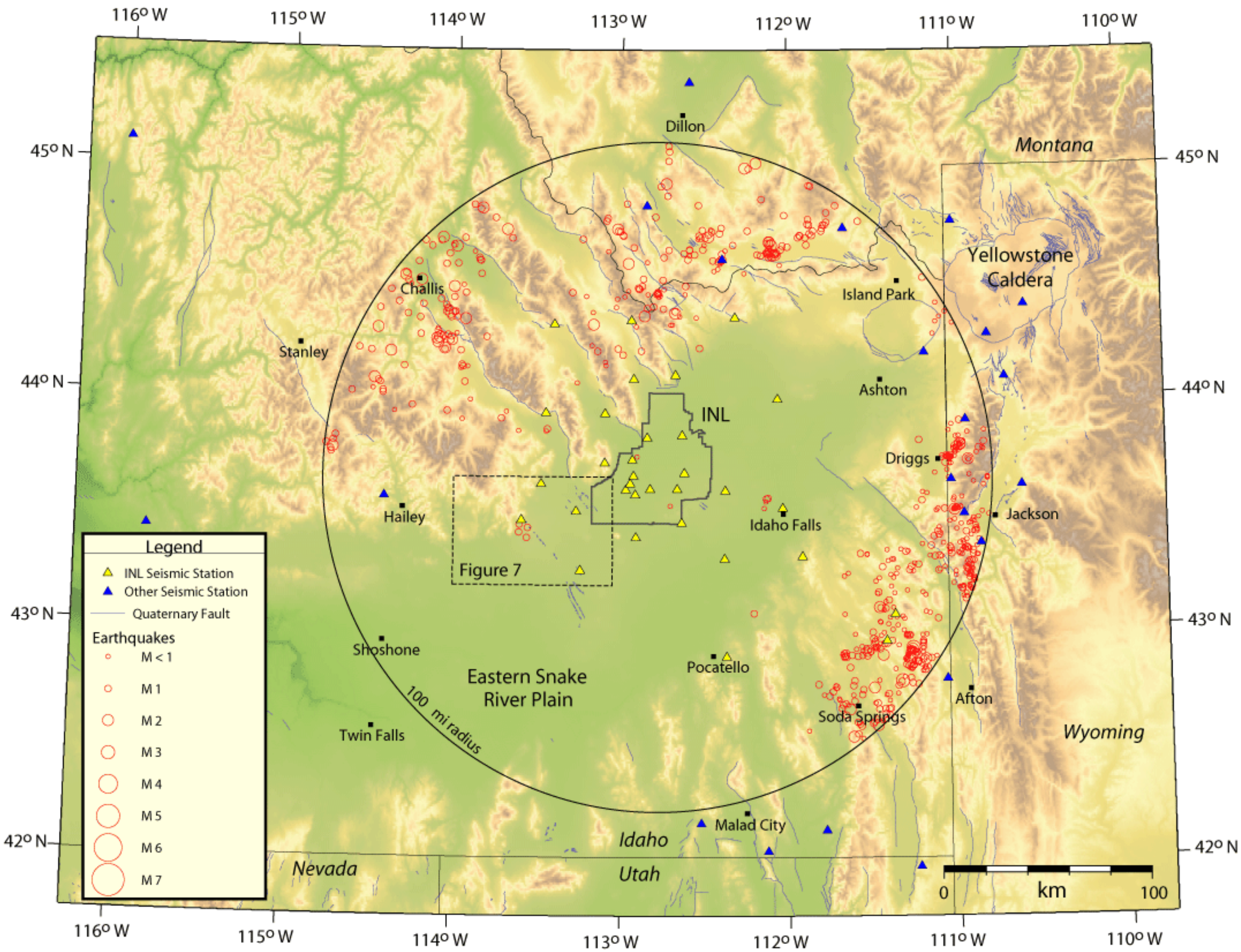

Figure 6. Map of epicenters of earthquakes within the 161-km radius around the INL from January 1, 2012 to December 31, 2012. Dashed box shows the region for Figure 7.

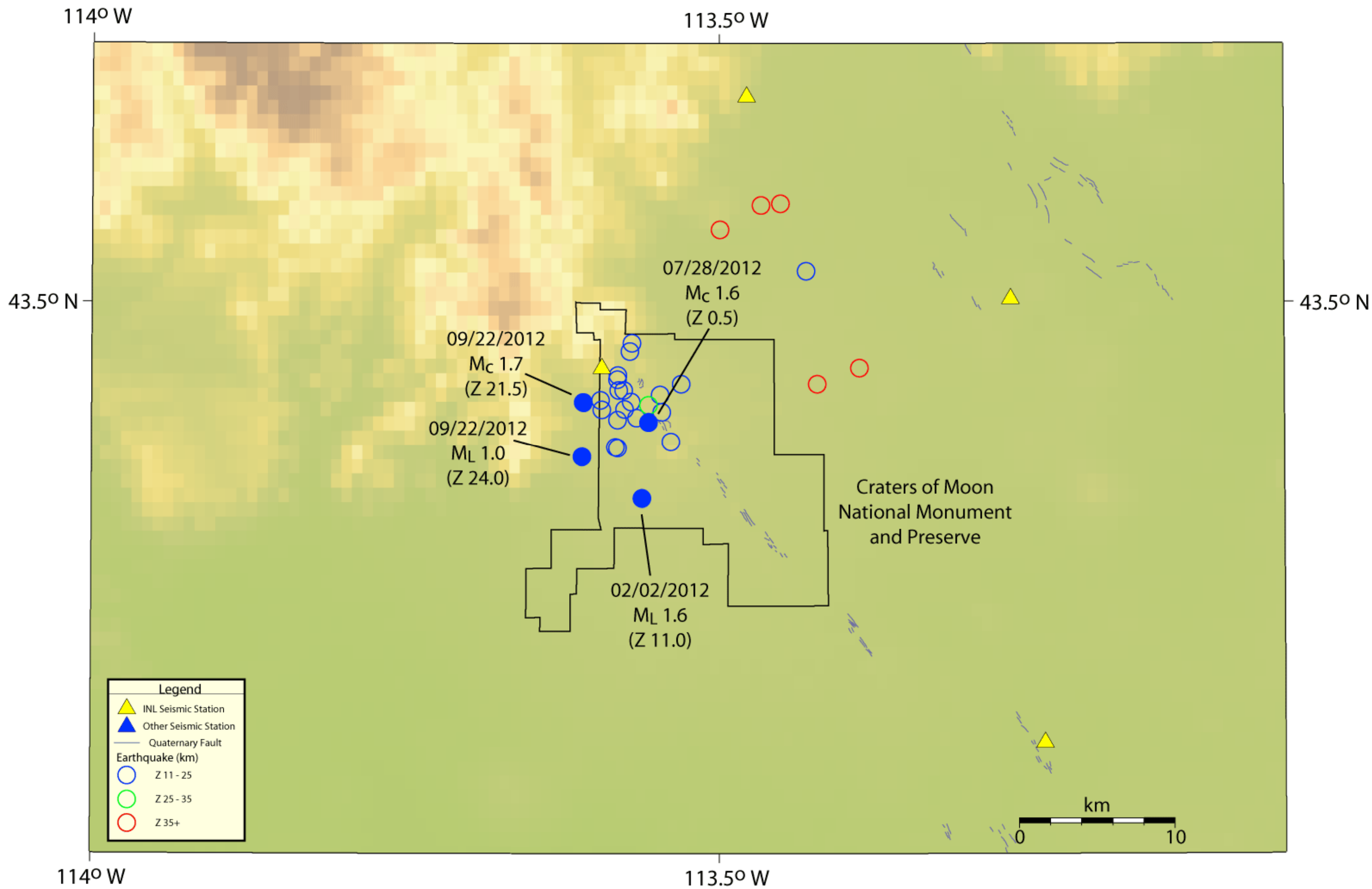

Figure 7. Map shows epicenters of earthquakes (colored by focal depth) at Craters of the Moon National Monument and Preserve (black polygon) from 1999 to 2012 (Carpenter and Payne 2009). The four 2012 earthquakes (solid blue circles) are shown with dates, magnitude, and depth (Z).

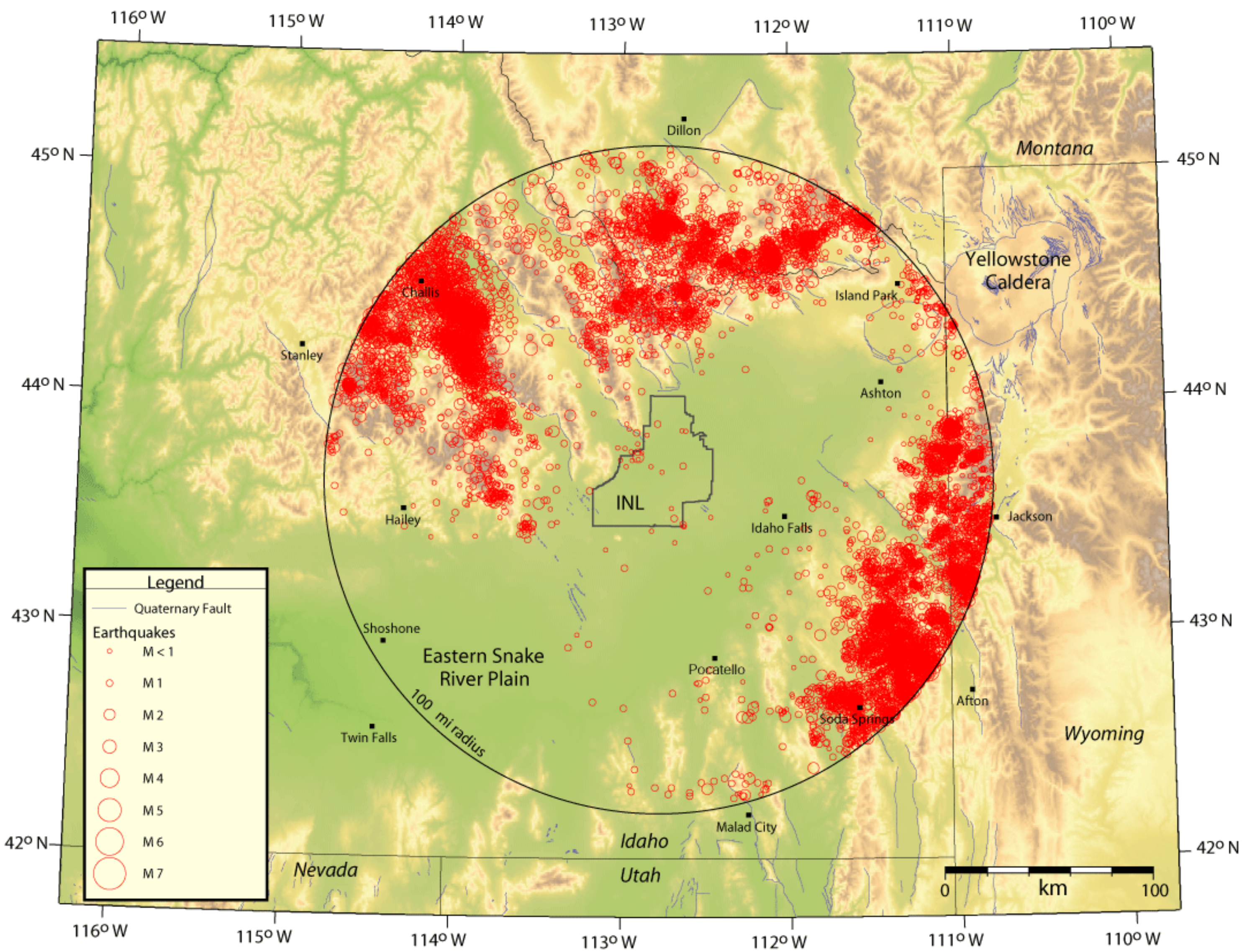

Figure 8. Map of epicenters of earthquakes from 1972 to 2012 within the 161-km (100 mile) radius around the INL.

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Appendix A

Seismic Network and Earthquake Information

A-1. INL Seismic Network History

The INL seismic network has evolved from a single analog station to its current configuration of 27 digital seismic stations. The INL Seismic Monitoring Program also records data from seismic stations owned and operated by other seismic networks. The INL seismic network began with a single station in 1971 and expanded to three stations by October of 1972. In 1977, the INL began monitoring a station operated by BYU-Idaho in Rexburg, Idaho. The INL installed two additional stations in 1979 and from 1979 to 1985, the INL monitored earthquake activity using six seismic stations. In 1985, the INL installed a simulated Wood-Anderson system to improve the capabilities of measuring the magnitude of local earthquakes ($3.0 \leq M \leq 5.0$). During 1986, the INL began receiving seismic data from a station located in Pocatello, Idaho and operated by the University of Utah in Salt Lake City, Utah. Also in 1986, the INL began receiving data from a station located near Palisades Reservoir, Idaho that is operated by BYU-Idaho. A seismic station within the INL boundaries was added to the INL seismic network in 1987.

From 1990 to 1994, INL seismic network underwent a major expansion of seismic stations. During 1990, four seismic stations were installed within the INL boundaries. From 1991 to 1992, thirteen new stations were installed in support of construction and operation of the proposed New Production Reactor at INL. Shallow boreholes (<20 m) were drilled for seismic stations located within the ESRP. Also, monitoring of BYU-Idaho seismic station near Palisades Reservoir was terminated in 1991 to accommodate the addition of the new INL seismic stations. In 1994, two new INL seismic stations were installed near Gray's Lake, Idaho.

Several changes occurred to seismic stations from 1999 to 2003. During 1999, the INL Howe Scarp, Idaho (HWSI) seismic station was relocated further east to a new location now referred to as the Howe Fault, Idaho or HWFI because of a lawsuit filed against the Bureau of Land Management. With the implementation of the "EARTHWORM" computer software in 2000, up to 14 stations from several nearby networks were being recorded in real-time along with the INL seismic stations. During 2001-2003, analog seismic instruments at all INL seismic stations were replaced with digital instruments. In 2003, the University of Utah transferred ownership of the Pocatello, Idaho (PTI) seismic station to the INL Seismic Monitoring Program at which time a digital seismic station was installed. With addition of the PTI station, INL has operated 27 seismic stations from 2003 through 2012.

A-2. INL Strong Motion Accelerograph History

The INL accelerograph network, which began by installing eleven SMAs in critical INL facilities, consists of SMAs installed in buildings at INL facility areas and at free-field sites for both rock and soil conditions. The original network was composed of three SMAs installed within buildings at the Idaho Nuclear Technology and Engineering Center (INTEC) (formerly referred to as Idaho Chemical Processing Plant - ICPP), two located within the Materials and Fuels Complex (MFC) facilities (formerly referred to as Argonne National Laboratory – ANL), three installed within the Power Burst Facility (PBF), two located within buildings at the Advanced Test Reactor (ATR) (formerly referred to as Test Reactor Area – TRA), and one located at the Old Fire Station (OFS). From 1978 to 1979, four SMAs were installed at Test Area North (TAN) within the Containment Test facility (formerly referred to as Loss of Fluid Test – LOFT facility). Just prior to the October 1983 surface-wave magnitude (M_s) 7.3 Borah Peak, Idaho earthquake, one SMA was installed at the IRC, which is now part of the REC in Idaho Falls, Idaho. Following the 1983 earthquake, two SMAs were installed within buildings at the Naval

Reactor Facility (NRF). In 1984, two additional SMAs were placed within buildings at INTEC. During 1990, one SMA was installed at the Central Facilities Area (CFA). A digital SMA was co-located with an analog SMA at MFC in 1993. In 1996, two free-field SMA sites were installed, one at NRF and the other at PBF. In 1997, one SMA was installed as a free-field site at the Radioactive Waste Management Complex (RWMC). In 2003, the SMAs were upgraded to digital NetDAS SMAs. At that time, one NetDAS digital SMA replaced two SMAs co-located at Building ANL-767 (Kinemetrics analog SMA-1 and digital SSA-2 accelerographs). The SMA on the crane beam at PBF-620 was not upgraded, but removed due to decommissioning activities.

Over the years, several SMAs have been relocated because buildings have been decommissioned and demolished. In 1995, the SMA at OFS was moved to a storage building directly behind the fire station because the fire station was decommissioned. In 1997, when the storage building was demolished, this SMA was relocated to the Experimental Field Station (EFS). In 1996, the Containment Test facilities, or LOFT facilities, were decommissioned. Three of the SMAs from LOFT were moved to the TAN Hot Shop and one was placed at the TAN Air Monitoring building. In 1997, the SMA at CFA was relocated to CFA-1607 Refueling Building. In 2004, the TAN Air Monitoring building was demolished so the SMA was removed and was reinstalled in 2005 as a free-field near the TAN Hot Shop. In 2004, the PBF building was demolished and the three SMAs were removed. The SMAs were reinstalled in 2005 as free-field sites near PBF and RWMC. In 2006, four SMAs at TAN were removed due to demolition of the TAN Hot Shop. In 2007, two of these SMAs were reinstalled; one was installed at the Special Manufacturing Complex (SMC) and the other at a free-field site east of SMC. In 2008, two SMAs were removed as a result of building demolition activities. One SMA at INTEC in building CPP-668 and one at ATR were removed. These SMAs were reinstalled at TAN and the New Production Reactor seismic station, NPRI. During 2009, two SMAs were removed at INTEC from building CPP-601 as a result of building demolition activities. In 2010, the SMA at CFA, called EFSF, was uninstalled, moved to the nearby pump house, and renamed to PHFF.

Three-component accelerometers and SMAs were added to some of the seismic stations. In 2002, accelerometers were added to four seismic stations: Bear Canyon (BCYI), Gray's Range (GRRI), NPRI, and HWFI. In 2003, accelerometers were added to seismic stations Telchick Spring, Idaho (TCSI), Split Crater (SPCI), and PTI. In 2004, the accelerometer at TCSI was uninstalled. In 2008, a free-field SMA was installed at the Craters of the Moon (COMI) seismic station. During 2012, the INL Accelerograph Network operated up to 20 SMAs within or near INL Site facility areas, two sites outside of the INL boundary (IRC and COMI), and five three-component accelerometers installed at seismic stations for a total of 27 sites with acceleration recording capabilities.

A-3. Evolution of INL Seismic Data Acquisition and Analysis Computer System

INL began recording earthquake data on the DAAS June 8, 1991 using the U. S. Geological Survey (USGS) CUSP processing software. Since 2001, significant upgrades have been made to the DAAS as a result of computer hardware and software advances. The USGS's CUSP data acquisition and analysis software supported use of the TIMIT program, which was used to analyze earthquake data from June 1991 to November 2002. The USGS CUSP and TIMT software packages were replaced in 2002 with the earthquake analysis program SEISAN (developed by the University of Bergen, Norway) and the USGS EARTHWORM processing software in 2003. As of December 2002, earthquake data are analyzed using the SEISAN program and is still in use today. Use of the SEISAN and EARTHWORM programs facilitate the upgrades of seismic stations and SMAs to currently available digital data loggers and sensors, which enables concurrent waveform analyses of both velocity and acceleration data.

A-4. INL Seismic Network Telemetry

Digital radios, Internet, or DSL links transmit seismic data from INL seismic stations and free-field SMAs to the IRC. Some seismic stations are used as relay links to transmit several seismic stations to a DSL drop point or directly to the IRC. Figure A-1 shows the telemetry configuration during 2012.

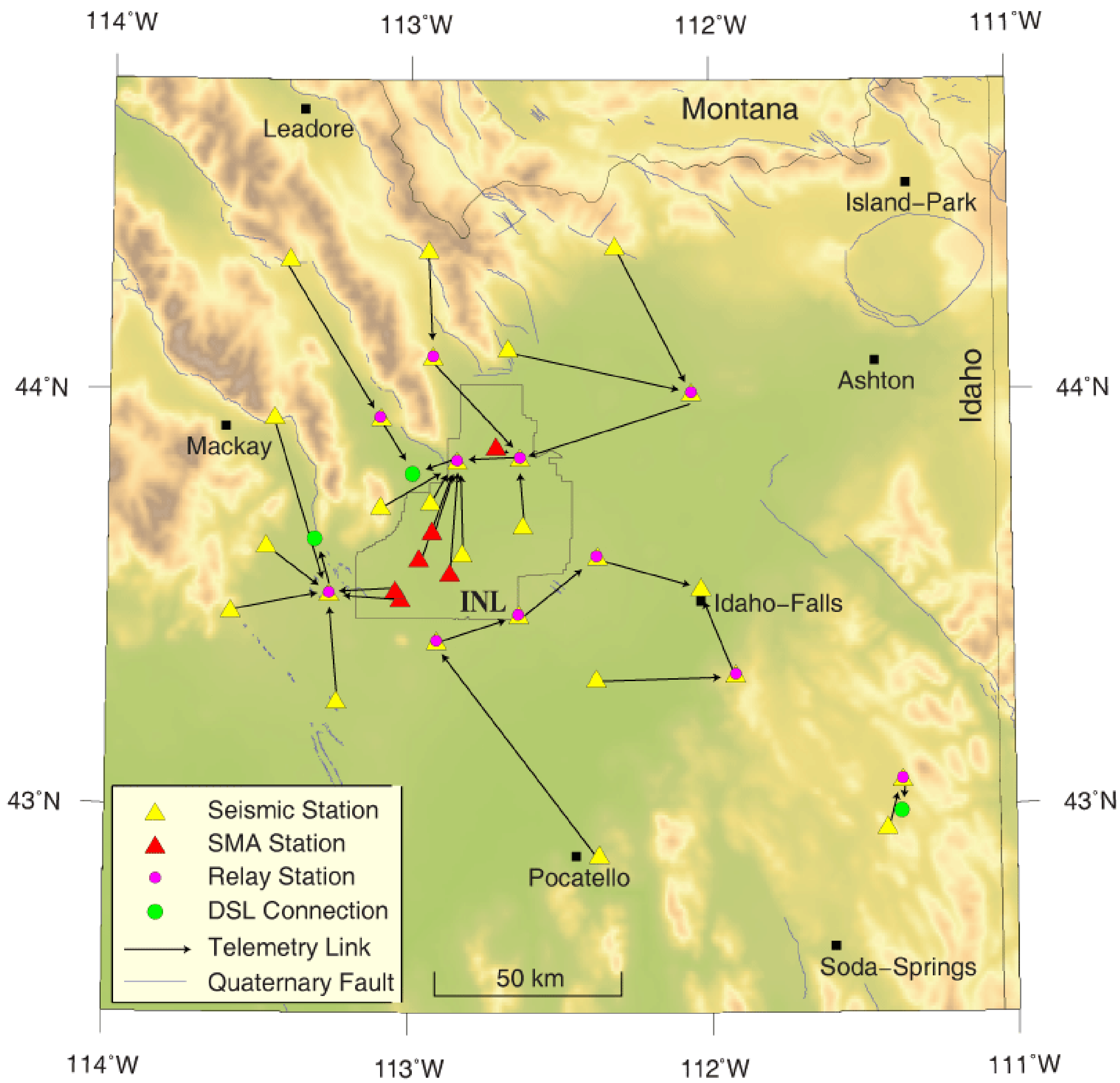


Figure A-1. Telemetry configuration of INL seismic stations and free-field SMAs during 2012.

A-5. 1995 Evaluation of INL Seismic Network Location Quality

In 1995, the State of Idaho at that time requested that Zollweg and Sprenke (1995) perform an independent assessment of the INL Seismic Monitoring Program. Zollweg and Sprenke (1995) evaluated the location accuracy of the INL seismic network by two methods: 1) directly comparing INL locations to well-located earthquakes; and 2) indirectly by evaluating the network bias or non-random error through varying independent permutations (or combinations) of recording stations.

For the first method, twenty-two earthquakes having high-quality locations determined from a temporary seismic network installed near Challis, Idaho from July 1, 1992 to July 12, 1992 (by Boise State University) were compared to INL locations for these earthquakes. The earthquakes were located about 120 km from the center of INL, had varying magnitudes ranging from 1.9 to 4.5, and had absolute errors less than 1 km. The epicenters determined by INL seismic stations for these events differed by 1.6 to 11.5 km with an average of 7.1 km. The differences in locations were dependent on magnitude, with the smaller magnitude earthquakes tending to have greater differences in locations (Zollweg and Sprenke, 1995). These results are similar to the earlier estimates of an error radius of 5 km for a comparison to high-quality locations of the aftershocks from the surface-wave magnitude (M_s) 7.3 October 28, 1983 earthquake (Jackson et al., 1993a). However it is noted that this estimate for an error radius was based on having five stations in the INL seismic network at that time. The closest station to the aftershocks was at a distance of 50 km or more.

The second method used by Zollweg and Sprenke (1995) evaluates the network bias. Unless all earthquakes are located using exactly the same groups of stations and phases (P- and S-wave arrivals), the relative locations will be affected by a non-random error or network bias. The network bias is important for the smaller earthquakes that make up the majority of the events in a catalog since fewer stations usually record smaller earthquakes. Five earthquakes located northwest of the INL seismic network and ranging in magnitude from 1.8 to 3.8 were used in the analysis. Because INL operated 26 seismic stations at the time of the assessment, there were millions of possible combinations of recording stations. Zollweg and Sprenke (1995) chose to vary the combination of the ten most influential phase arrivals for the permutation analysis. The locations for most of the permutations clustered about radii ranging from 6.5 to 11 km. For the magnitude 3.8 earthquake, 8% of the permutations resulted in a linear band extending 100 km. Zollweg and Sprenke (1995) suggested that earthquakes located with fewer S-wave arrival times have less well-constrained locations. Some of the larger earthquakes, like the magnitude 3.8 earthquake, have fewer S-wave arrival times because the signals saturate the instrumentation and onset of the S- wave is indistinguishable from the P-waves. Earthquakes with more than three S-wave-arrival times resulted in better-constrained locations.

A-6. Earthquake Intensity Maps

The U.S. Geological Survey with the cooperation of various regional seismic networks provide a web page where people who experience an earthquake can go online and share information about its effects to help create a map of shaking intensities and damage. The “Community Internet Intensity Maps” contribute toward the quick assessment of the scope of an earthquake emergency and provide valuable data for earthquake research (U.S. Geological Survey, 2014). The Web site is called “Did You Feel It?” and is the place where a person can enter their ZIP Code and answer a list of questions about what they felt and what damage occurred. Figures A-2, A-3, and A-4 show the responses from local residents and their reported effects for the felt earthquakes discussed in Section 4.1.

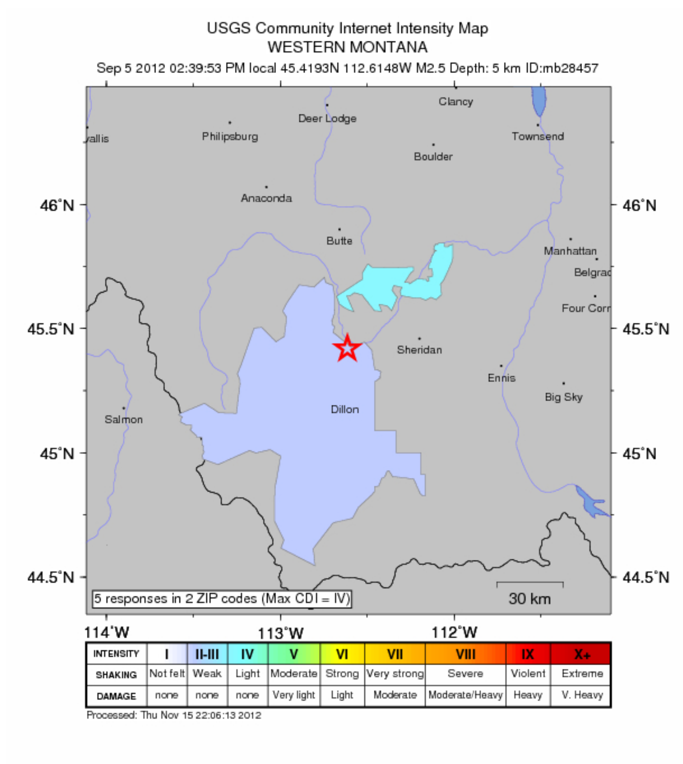
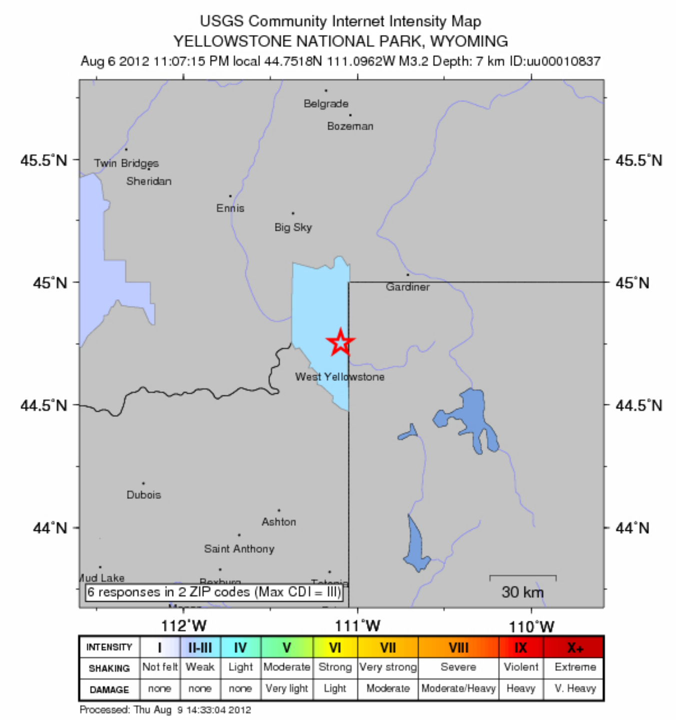


Figure A-2. Earthquake intensity map for the September 5, 2012 (20:39 UTC) M_L 3.3 earthquake located north of Dillon, Montana (U.S. Geological Survey, 2014).

a)



b)

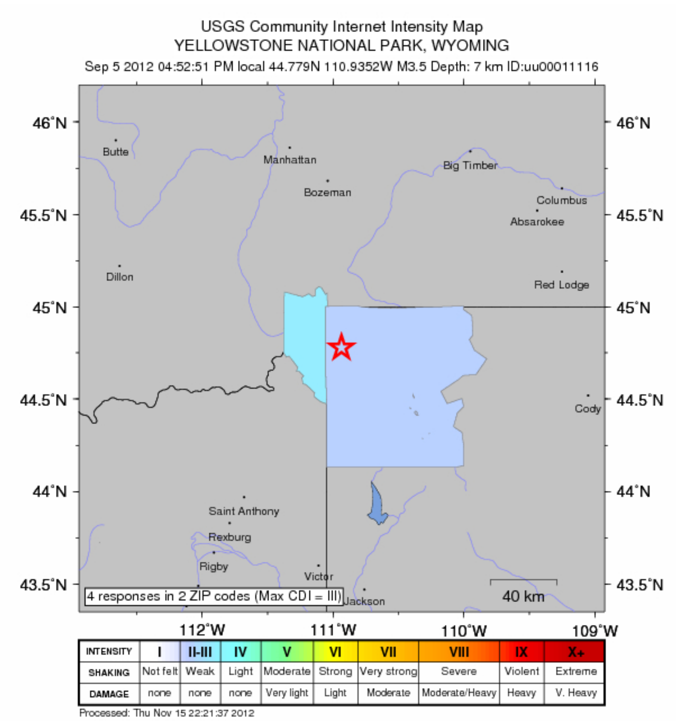
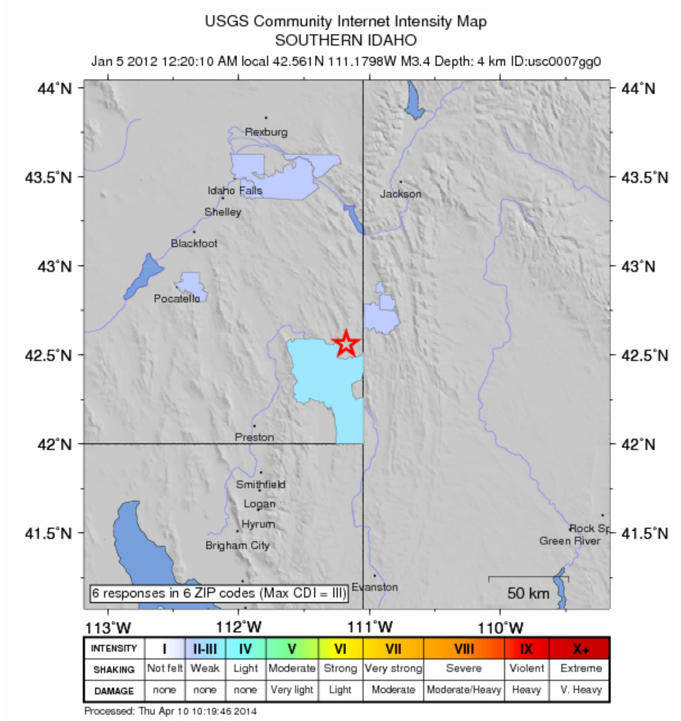


Figure A-3. Earthquake intensity maps for the: a) August 7, 2012 (05:07 UTC) M_L 3.2 earthquake; and b) September 5, 2012 (05:52 UTC) M_L 3.5 earthquake located near Yellowstone National Park, Wyoming (U.S. Geological Survey, 2014).

a)



b)

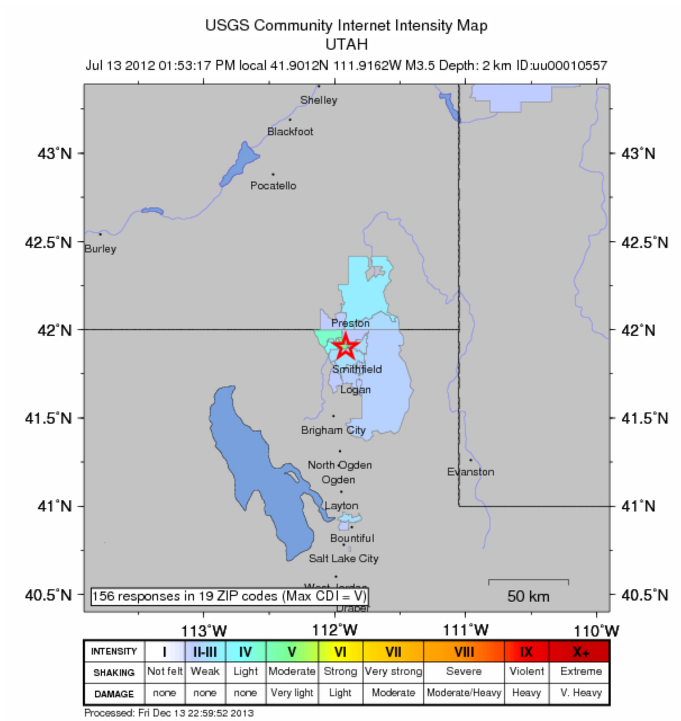


Figure A-4. Earthquake intensity maps for the: a) January 5, 2012 (07:20 UTC) M_L 3.4 earthquake located in Southeast Idaho; and b) July 13, 2012 (19:53 UTC) M_L 3.5 earthquake located in northern Utah (U.S. Geological Survey, 2014).

Appendix B

Instrument Response of NetDAS SMAs

B.1 Method for Determining Amplitude Response

The instrument response (otherwise known as sensitivity) of the NetDAS-SMA is used to convert the measured counts of ground motion amplitude to units of g. Instrument responses for NetDAS units that have accelerometers mounted within the unit are determined by conducting 1-g (acceleration of gravity) tilt tests. These tests are done on a leveled pad at the IRC seismic lab or on the actual leveled pad at their physical location listed in Table 3. These 1-g tilt tests provide a relationship between the number of digitizer counts and the 1-g offset. Equation B-1 provides the conversion from the measured count level to actual g level for the recorded motion. Trigger threshold accelerations and counts/g are listed for NetDAS units with SMAs in Table B-1 using equation:

$$\text{Acceleration (g)} = \text{Counts}_{\text{(Measured or target)}} / \text{(Counts/g)} \qquad \text{[B-1]}$$

For accelerographs without internally installed accelerometers within the NetDAS units, Equation B-1 does not apply due to an inability to perform analogous tilt tests. For all systems, however, there is a frequency dependent amplitude response, which is discussed further in Appendix C. Table B-2 lists the instrument response for these accelerometers using the methods discussed in Appendix C.

Tables B-1 and B-2 list the beginning and ending dates for the time periods that the instrument responses are applicable. Also, note that the building numbers and locations for the SMA codes are listed in Table 3. If changes occurred to SMA or seismic station instrumentation (such as accelerometer or NetDAS unit) during the year, then more than one range of dates are listed for a location. In cases where earthquakes have never been recorded by the unit, then only the most recent instrument response is included. As stated in Section 2.2, the accelerometers are set to trigger at thresholds <0.005 g.

Table B-1. Instrument responses for strong-motion accelerographs (all have PAR4CH digitizers).

Location/INL Site Facility Area	Site Code	Instrument Response Begin Date	Instrument Response End Date	NetDAS Serial #	Accelerometer Model	Accelerometer Serial #	Orientation	Counts/g
ATR	TRAF	11/15/2010	12/31/2012	1094	SF2500A	41	Vertical	542429
							North	559600
							East	552564
ATR	TRAB	11/15/2010	12/31/2012	1083	SF2500A	44	Vertical	551948
							North	556780
							East	504501
CFA	CFAF	10/20/2010	12/31/2012	1097	SF2500A	37	Vertical	551532
							North	544061
							East	558387
COMI[a]	COMF	8/20/2008	12/31/2012	1080	SF2500A	51	Vertical	549804
							North	567877
							East	553058
EFS	PHFF	8/17/2010	12/31/2012	1096	SF2500A	49	Vertical	561102
							North	530779
							East	535983
INTEC	FAS1	2/2/2006	12/31/2012	1084	SF2500A	48	Vertical	573249
							North	573389
							East	546041
INTEC	FAS2	2/2/2006	12/31/2012	1082	SF2500A	52	Vertical	544357
							North	549370
							East	565218
MFC	EBR1	2/8/2006	12/31/2012	1095	SF2500A	46	Vertical	533228
							North	555864
							East	543393
MFC	FCF1	6/2/2003	12/31/2012	1079	SF2500A	61	Vertical	549212
							North	559404
							East	558307
NRF	NRFF	1/31/2005	11/08/2010	1098	SF2500A	55	Vertical	540182
							North	553738
							East	551745

Table B-1. Continued.

Location/INL Site Facility Area	Site Code	Instrument Response Begin Date	End Date	NetDAS Serial #	Accelerometer Model	Serial #	Orientation	Counts/g
NRF	NRFF	11/08/2010	12/31/2012	1098	SF2500A	609	Vertical	473979
							North	491200
							East	489358
NRF	A1W	11/08/2010	12/31/2012	1091	SF2500A	53	Vertical	548654
							North	571896
							East	555972
NRF	S1W	1/31/2005	12/31/2012	1088	SF2500A	45	Vertical	561125
							North	558488
							East	558473
PBF	PBFF	11/12/2008	12/31/2012	1089	SF2500A	50	Vertical	559649
							North	550303
							East	559707
PBF	ARAF	10/20/2010	12/31/2012	1086	SF2500A	35	Vertical	527786
							North	564825
							East	547053
RWMC	RWMC	9/20/2007	12/31/2012	1081	SF2500A	42	Vertical	552610
							North	554529
							East	572590
RWMC	RWME	9/20/2007	12/31/2012	1077	SF2500A	40	Vertical	552358
							North	540927
							East	556424
REC	IRCF	10/20/2010	12/31/2012	1093	SF2500A	47	Vertical	578185
							North	570966
							East	543190
TAN	TANA	10/31/2008	10/20/2010	1090	SF2500A	56	Vertical	558999
							North	557465
							East	531326
TAN	TANA	10/20/2010	12/31/2012	1090	SF2500A	56	Vertical	554009
							North	556780
							East	531537

Table B-1. Continued.

Location/INL Site Facility Area	Site Code	Instrument Response		NetDAS Serial #	Accelerometer			
		Begin Date	End Date		Model	Serial #	Orientation	Counts/g
TAN	TAN4	7/28/2008	12/31/2012	1089	SF2500A	38	Vertical	631860
							North	514585
							East	655111
TAN	SMC	4/10/2012	12/31/2012	2000	SF2500A	34	Vertical	562678
							North	555579
							East	563564

NA – Not available.
a. - SMA co-located at an INL seismic station.

Table B-2. Instrument responses of accelerometers located at seismic stations.

Seismic Station	Instrument Response Begin Date	End Date	NetDAS Serial #	Accelerometer Model #	Serial #	Orientation	Datalogger Counts/Volt	Sensor Volt/g	Station Counts/g
BCYI	5/06/2009	12/31/2012	1068[a]	SF3000L	614	Vertical	2841402	1.220	3466510
						North	2834135	1.200	3400962
						East	2838854	1.220	3463402
GRRI	11/04/2008	12/31/2012	1013[b]	SF3000L	185	Vertical	3932869	1.396	5490285
						North	4014708	1.345	5399782
						East	3980407	1.412	5620335
HWFI	9/09/2008	12/31/2012	1069[b]	SF2500A	62	Vertical	1757768	1.378	2422204
						North	1173136	1.371	1608369
						East	19243242	1.352	26016863
NPRI	10/21/2005	12/31/2012	1065[b]	SF2500A	36	Vertical	810927	1.427	1157193
						North	802533	1.376	1104285
						East	808520	1.371	1108481
PTI	10/22/2008	12/31/2012	1071[b]	SF3000L	188	Vertical	835018	1.230	1027072
						North	835559	1.194	997657
						East	835957	1.244	1039931
SPCI	8/28/2007	12/31/2012	1070[b]	SF3000L	186	Vertical	834485	1.216	1014734
						North	834508	1.237	1032286
						East	835579	1.215	1015228

a. DAQ24USB5V digitizer.
b. PAR24B digitizer.

Appendix C

Instrument Response of Seismic Stations

C.1 Method for Determining Instrument Gain

The INL determines instrument responses (otherwise known as sensitivity) for both the four (4CH) and eight channel (8CH) NetDAS units. The INL establishes a DC counts/volt level by inputting a known voltage level for a specified duration of time for each channel on the NetDAS units and recording the mean and standard deviation in counts for this duration. The input voltage polarity is often reversed in order to obtain a greater measurement range. The mean provides the method to produce the DC counts/volt level (Equation C-1a and C-1b) and the standard deviation quantifies the measurement uncertainty and system noise.

Single ended:

$$\text{Counts/Volt} = \mu / v_i \qquad \text{[C-1a]}$$

Reversed Polarity:

$$\text{Counts/Volt} = (\mu + - \mu^-) / (v_i + - v_i^-) \qquad \text{[C-1b]}$$

Where:

μ is mean counts

v_i is input voltage

Subscript "+" is positive polarity

Subscript "– " is negative polarity

C.2 NetDAS-4CH Frequency Response

The response of the Symmetric Research PAR4CH (4CH) digitizer used in the NetDAS-4CH was calculated at the INL to establish the instrument response of NetDAS units and the methods incorporated vendor information. The DAQSystems, Inc., manufacturer of the NetDAS units, reviewed INL's frequency response results and methods, which is discussed in the following steps.

The NetDAS-4CH frequency response was determined empirically by measuring the output counts resulting from a known input signal. Trials were conducted using a constant-amplitude sine wave with frequencies varying between 0.1, 5, 10, 15, 20, 25, 30, and 35 Hz. The frequency sweep was performed twice for those frequencies. The averages of the measured counts at each frequency were then converted into decibel responses relative to the average response at 0.1 Hz, because the vendor data sheets list a gain of 1 at this frequency. A 2^{nd} order polynomial was then fit to the data creating a simple amplitude response in frequency. The perfectly matched response (R-squared of one) is shown here as described by Equations C-2 and C-3 (conversion to decibels).

$$Y_{dB} = -0.0045f^2 + 0.0074f - 0.014 \qquad \text{[C-2]}$$

$$dB = 20 \log (E_2/E_1) \qquad \text{[C-3]}$$

Where:

f – frequency (Hz)

E_1 – original signal level

E_2 - modified signal level

E_2/E_1 – commonly referred to as gain

This relationship was then used to calculate the gains out to the Nyquist frequency (1/2 the sample rate). The INL samples all data at 100 samples per second or 0.01 Hz. The information was then entered into MATLAB, which has a function to determine poles and zeros. Poles and zeros are the instrument response format that many seismic applications use to correct seismograms for instrument response. The NetDAS-4CH frequency response in dB and poles and zeros are shown in Figure C-1.

Equations C-2 and C-3 can be used in conjunction with the DC counts/volt measurement to generate a count-based frequency response for short hand calculations or spectral deconvolution to remove the frequency response.

$$Ycounts = Counts/Volt \times 10\text{^}((-0.0045f^2 + 0.0074f - 0.014)/20) \qquad [C\text{-}4]$$

Where:

^ - Indicates 10 to the power of the number calculated in parentheses.

However, the preferred method for removing the frequency response from a recorded waveform is to use a seismic analysis package, such as SEISAN. This program recognizes the poles and zeros representation of instrument response, which quickly and accurately corrects recorded waveforms to actual ground motions.

C.3 NetDAS-8CH Frequency Response

The response of the Symmetric Research PAR24B (8CH) digitizer used in the NetDAS-8CH was based on vendor provided information, and calculated in the same method as described above for the PAR4CH. A 2nd order polynomial was fit to the data creating a simple amplitude response in frequency that matched the amplitude response (R-squared of 0.999). Equation C-5, listed below, is similar to Equation C-3 used for the response of the NetDAS-4CH. The NetDAS-8CH frequency response in dB and poles and zeros are shown in Figure C-2.

$$Y_{dB} = -0.0045f^2 + 0.0071f - 0.0158 \qquad [C\text{-}5]$$

C.4 Short-period seismic station frequency response data

In the fall of 2002, INL seismic personnel began tracking instrument response of the seismic stations. These response values, in combination with the instrument frequency responses (see C.2 and C.3), are used to create site- and date-specific system response files for the INL seismic stations. These response files are used in SEISAN to correct waveforms for further analyses such as calculating magnitudes by measuring amplitudes. Table C-1 lists the most recent measured responses (including any system amplification) for the seismic stations that have been measured for instrument responses (in counts/volt).

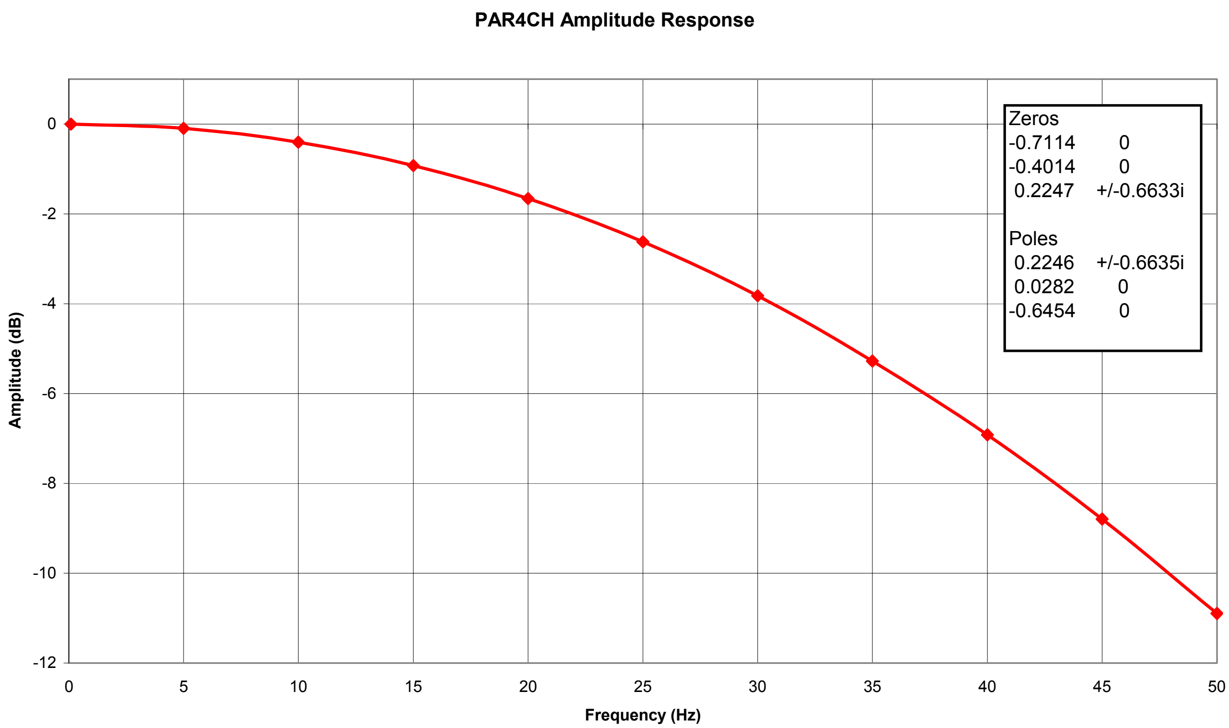


Figure C-1. Amplitude verses frequency system response of the Symmetric Research PAR4CH digitizer used in the NetDAS-4CH.

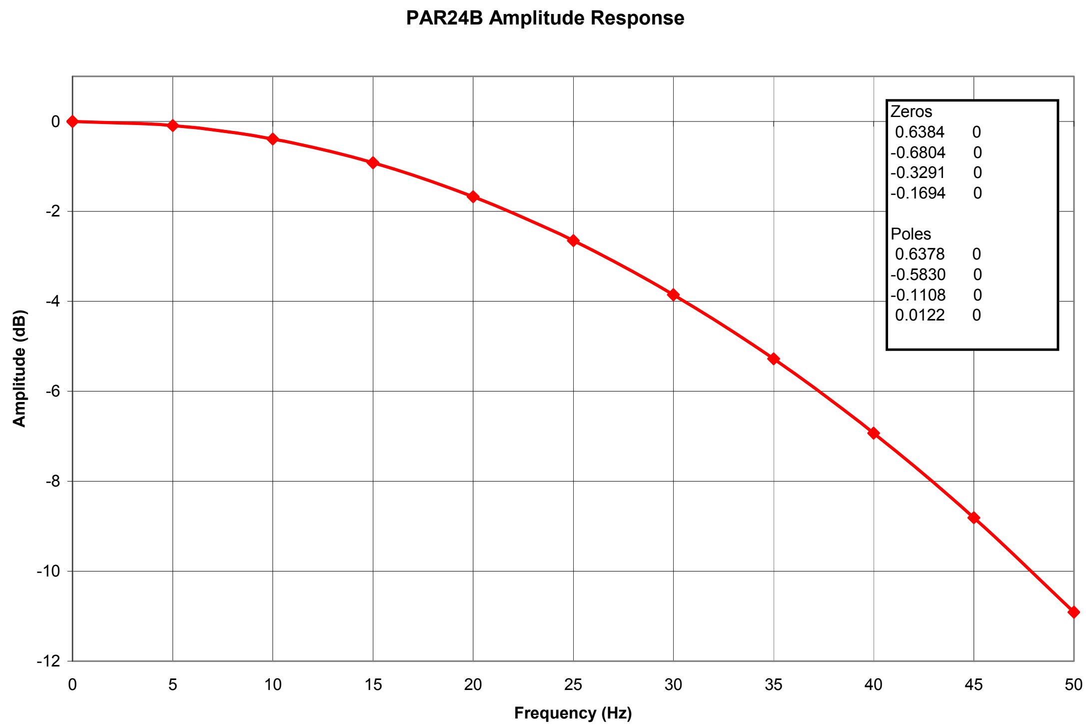


Figure C-2. Amplitude verses frequency system response of the Symmetric Research PAR24B digitizer used in the NetDAS-8CH.

Table C-1. Instrument responses of seismometers located at seismic stations.

Seismic Station	Instrument Response Begin Date	End Date	NetDAS Serial #	Digitizer Model	Orientation	Datalogger Counts/Volt	Seismometer Model
Single-component seismic stations							
ARNI	8/28/2007	12/31/2012	1017	4CH	Vertical	47977741	S13J
BCYI	5/06/2009	5/24/2012	1068	24USB5V	Vertical	2840730	S13J
BCYI	5/24/2012	12/31/2012	1068	24USB5V	Vertical	Not Measured	L4C
CBTI	8/29/2007	12/31/2012	1024	4CH	Vertical	48948934	S13J
CNCI	9/29/2009	12/31/2012	1066	24USB5V	Vertical	2851620	L4C
COMI	9/21/2007	12/31/2012	2005	4CH	Vertical	36022837	S13
CRBI	8/28/2006	12/31/2012	1027	4CH	Vertical	401458	S13J
COMI	12/03/2008	12/31/2012	1025	24USB5V	Vertical	2834323	S13
ECRI	10/23/2009	12/31/2012	1051	4CH	Vertical	46797192	S13
EMI	9/13/2007	12/31/2012	1019	4CH	Vertical	48487157	L4C
GBI	12/01/2009	4/18/2012	30802	24USB5V	Vertical	2838478	S13J
GBI	4/18/2009	12/31/2012	30802	24USB5V	Vertical	Not Measured	L4C
GRRI	11/04/2008	12/31/2012	1013	24USB5V	Vertical	2831677	L4C
GTRI	11/24/2008	12/31/2012	9001	24USB5V	Vertical - borehole	2776147	L4C
	11/24/2008	12/31/2012	9001	24USB5V	Vertical - surface	2949858	L4C
HHAI	10/22/2008	12/31/2012	1014	4CH	Vertical	458174	L4C
HPI	9/13/2007	12/31/2012	1015	4CH	Vertical	47682925	L4C
ICI	9/13/2007	12/31/2012	1020	4CH	Vertical	48888117	L4C

Table C-1. Continued.

Seismic Station	Instrument Response Begin Date	End Date	NetDAS Serial #	Digitizer Model	Orientation	Datalogger Counts/Volt	Seismometer Model
KBI	8/28/2007	12/31/2012	1018	4CH	Vertical	45839400	S13J
LJI	9/09/2008	12/31/2012	1052	4CH	Vertical	48429387	S13J
PTI	10/22/2008	12/31/2012	1071	8CH	Vertical	86459806	S13
PZCI	9/11/2008	12/31/2012	1023	4CH	Vertical	47216457	S13J
SMBI	9/10/2008	12/31/2012	1064	24USB5V	Vertical	2835711	L4C
TCSI	9/10/2008	12/31/2012	1010	24USB5V	Vertical	2873122	L4C
Three-component seismic stations							
HWFI	9/09/2008	12/31/2012	1069	8CH	Vertical	86375959	S13
					North	86381403	S13
					East	84982876	S13
IRCI	4/22/2010	12/31/2012	1012	4CH	Vertical	456044	S13
					North	459462	S13
					East	462104	S13
JGI	9/11/2008	12/31/2012	30801	24USB5V	Vertical	2856927	S13
					North	2887634	S13
					East	2867169	S13
LLRI	5/12/2011	12/31/2012	1029	24USB5V	Vertical	2830795	L4C
					North	2840055	S13
					East	2767350	S13

Table C-1. Continued.

Seismic Station	Instrument Response Begin Date	End Date	NetDAS Serial #	Digitizer Model	Orientation	Datalogger Counts/Volt	Seismometer Model
NPRI	4/22/2011	12/31/2012	1065	8CH	Vertical	836486	L4C
NPRI	10/21/2005	12/31/2012	1065	8CH	North	837155	S13
NPRI	10/21/2005	12/31/2012	1065	8CH	East	839175	S13
SPCI	8/28/2007	12/31/2012	1070	8CH	Vertical	83330000	S13J
					North	83376700	S13
					East	83485300	S13
TCSI	9/10/2008	12/03/2012	1010	24USB5V	Vertical	2873122	L4C
					North	2887077	S13
					East	2868820	S13
TMI	9/22/2009	12/31/2012	2004	24USB5V	Vertical	2849495	S13
					North	2848510	S13
					East	2844713	S13

Note: The 4CH (PAR4CH) and 24USB5V (DAQ24USB5V) digitizers have the same poles and zeros, and are different from the poles and zeros for the 8CH (PAR24B).

C.5 Broadband seismometer frequency response

The INL seismic network has two broadband seismic stations (I14A and NPRI; see Section 2.1) which have two different types of sensors. Seismic station I14A has the three-component, Guralp CMG-3T (serial #T34313) broadband seismometer with a power consumption of 60 mA at 12 V input and a calibration resistor of 51,000 Ω. Table C-2 lists the seismometer sensitivity data and Table C-3 lists the seismometer frequency response data (in poles and zeros) for each component as determined on 12/20/2006 by EarthScope. The data acquisition system is a Quanterra Q330 (ID tag # 1554), the frequency is unity within the sampling rates employed at this station. The NPRI seismic station has the three-component, Nanometrics Trillium T120-PA broadband seismometer (serial #001025) has the combined sensitivity response nominal parameters listed in Table C-4. Table C-5 list the response for seven poles and five zeros provided by Nanometrics. The data acquisition system is a Quanterra Q330 (ID tag # 3870), the frequency is unity within the sampling rates employed at this station.

Table C-2. EarthScope-determined Guralp CMG-3T (serial #T34313) seismometer sensitivity.

Component	Velocity Output (V/m/s) (Differential)	Mass Position Output (V/m/s2) (Acceleration output)	Feedback Coil Constant(Amp/m/s2)
Vertical	2 x 741	1887	0.02516
North/South	2 x 750	2023	0.02697
East/West	2 x 745	2010	0.0268

Note: A factor of 2 x must be used when the sensor outputs are used differentially (also known as push-pull or balanced output).

Table C-3. EarthScope-determined Guralp CMG-3T (serial #T34313) seismometer frequency response.

Component	Poles (Hz)	Zeros (Hz)	Normalizing factor at 1 Hz
Vertical	$-5.89 \times 10^{-3} \pm j5.89 \times 10^{-3}$	0	2304000
	-180	0	
	-160		
	-80		
Horizontal (N-S and E-W)	$-5.89 \times 10^{-3} \pm j5.89 \times 10^{-3}$	0	2304000
	-180	0	
	-160		
	-80		

Table C-4. Combined calibration response nominal parameters for Nanometrics Trillium T120-PA (serial #001025) seismometer.

Parameter*	Nominal Values
Zeros (z_n in radians/second)	0 0 -90.0
Poles (p_n in radians/second)	-0.03852 ± 0.03658i -178 -135 ± 160i -671 ± 1154i
Normalization factor (κ in radians/second)	1.540×10^{11}
Normalization Frequency (f_0 in Hz)	1
Combined calibration sensitivity at f_0 (radians/second)	12.28

* The units of the nominal values are rad/s because the calibration input produces an equivalent acceleration, while the seismometer passband is flat to velocity. Therefore, to determine the expected gain for a sinusoidal calibration, you must divide the sensitivity listed above by 2πf, where f is the frequency of the sinusoid.

Table C-5. Poles and zeros for the Nanometrics Trillium T120-PA (serial #001025) seismometer.

Poles	
-3.852×10^{-2}	3.658×10^{-2}
-3.852×10^{-2}	-3.658×10^{-2}
-1.78×10^{-2}	0.000
-1.35×10^{2}	1.60×10^{2}
-1.35×10^{2}	-1.60×10^{2}
-6.71×10^{2}	11.54×10^{2}
-6.71×10^{2}	-11.54×10^{2}
Zeros	
0.00	0.00
0.00	0.00
-0.90×10^{2}	0.00
-1.607×10^{2}	0.00
-31.080×10^{2}	0.00

Appendix D

2012 Earthquake List

The summary list of earthquakes includes those located within a 161-km (100-mile) radius of the INL centered at 43.0° 39.00' N, 112° 47.00' W. Table D-1 provides an explanation of the headings listed in Table D-2 for the earthquake list. The format for this table has been modified from previous years. The earthquake identification number is no longer reported since the SEISAN analysis package identification number is simply the origin data and time. The listing also includes the distance of the earthquake epicenter from the center of INL.

Table D-1. Explanation of the earthquake summary table headings.

Heading	Example	Explanation
ORIGIN	1/1/2012 1:20:05	Date of the earthquake: month/day/year; origin time of the earthquake: hour, minute, and second in UTC
LAT N	44.3367	Latitude of epicenter in degrees North
LONG W	-114.2208	Longitude of epicenter in degrees West
MAG-	1.9	Magnitude of the earthquake. NM signifies that no magnitude was determined for this earthquake.
TYPE	Mc IE	Type of magnitude reported and reporting agency. Magnitude types: Coda magnitude (Mc); Local magnitude (ML); Moment magnitude (Mw); and Body wave magnitude (mb). Reporting agencies include: Idaho National Laboratory (IE); NEIC (US); University of Utah (UU); and Montana Bureau of Mines and Geology (MB); Wyoming (WY). NM with a magnitude of 0.00 indicates that no magnitude was calculated as a result of multiple earthquakes, which obscures the coda of the first event or the record length was insufficient to include the full coda of the earthquake.
DIST	138.3	Distance in km from center of INL at: 43° 39.00' N, 112° 47.00' W.
Z	4.96	Calculated focal depth in km. Not all earthquakes have appropriate seismic station geometry for calculating a reliable focal depth, thus the errors (ERZ) are typically large.
NO	8	Number of station readings used in locating the earthquake with weights above 0.1. P- and S-wave arrival times for the same station are regarded as two readings.
GAP	232	Largest azimuthal separation in degrees between stations.
DMIN	65.1	Distance in km from the epicenter to the nearest station.
RMS	0.06	Root mean square error of arrival time residuals in second using all weights as calculated by: $RMS=SQRT(\Sigma W_i*R_i^2/N)$
		Where: SQRT is the square root; ΣW_i*R_i is the sum of the time residuals for the i^{th} arrival times the weight assigned to that arrival time; and N is the number of residuals.
ERH	1.1	Standard horizontal error of the epicenter in km.
ERZ	3.8	Standard vertical error of the focal depth in km.

Table D-2. Earthquakes located within 161-km radius of INL in 2012.

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
1/1/2012 1:20:05	44.3367	-114.2208	1.9 Mc IE	138.3	4.96	8	232	65.1	0.06	1.1	3.8
1/1/2012 14:41:32	44.1958	-113.9703	1.3 Mc IE	113.0	8.79	7	227	46.9	0.04	1.0	12.7
1/2/2012 1:09:38	43.0590	-112.2075	1.3 Mc IE	80.6	8.53	14	112	24.8	0.07	0.4	1.2
1/3/2012 7:21:52	44.6683	-112.1003	1.3 Mc IE	125.8	12.63	8	118	24.8	0.08	0.7	1.7
1/3/2012 13:46:17	43.2737	-110.9338	1.0 ML IE	155.3	2.26	11	159	11.9	0.11	0.8	14.1
1/4/2012 1:19:54	44.3622	-112.6812	2.5 Mc IE	79.7	11.53	22	90	34.4	0.06	0.4	1.8
1/4/2012 18:48:53	42.9832	-111.3220	0.7 Mc IE	139.8	0.05	7	115	8.8	0.08	2.0	3.6
1/5/2012 13:39:32	43.2112	-111.3795	0.9 Mc IE	123.6	5.97	8	213	17.5	0.06	1.2	7.0
1/6/2012 21:46:38	42.8983	-111.2803	1.0 Mc IE	147.9	9.14	8	156	12.4	0.06	1.3	4.6
1/6/2012 21:47:40	42.8962	-111.2838	1.3 ML IE	147.8	10.89	11	159	12.2	0.05	0.9	2.7
1/7/2012 10:19:15	44.1325	-113.9632	1.3 Mc IE	108.9	7.19	8	215	46.8	0.11	1.0	15.4
1/7/2012 10:31:50	44.1272	-113.9557	1.5 Mc IE	108.1	6.96	11	213	46.0	0.05	0.7	13.2
1/9/2012 7:44:07	44.7550	-111.7653	1.0 ML IE	147.4	9.27	8	152	8.4	0.03	0.9	1.0
1/10/2012 2:18:36	44.6890	-111.8945	1.9 Mc IE	135.7	6.22	14	111	18.7	0.04	0.5	9.3
1/10/2012 5:06:52	44.1807	-112.9923	1.2 Mc IE	61.4	8.42	9	240	29.6	0.08	1.5	10.5
1/10/2012 16:07:15	42.6675	-111.4812	1.1 Mc IE	152.1	5.08	5	299	30.5	0.04	2.9	11.2
1/11/2012 7:19:28	44.8360	-112.9728	1.3 Mc IE	132.8	7.21	6	175	9.8	0.05	5.1	10.3
1/11/2012 7:29:57	42.9125	-111.2090	1.3 Mc IE	151.8	10.97	10	121	17.6	0.06	0.5	2.7
1/11/2012 17:10:57	42.6468	-111.4022	1.6 Mc IE	158.3	8.38	13	108	28.0	0.08	0.5	4.2
1/11/2012 23:00:49	44.0583	-113.9465	1.4 Mc IE	104.0	7.15	9	201	42.2	0.07	0.7	13.8
1/13/2012 10:47:13	42.8457	-111.2378	1.0 ML IE	154.1	11.32	9	177	14.4	0.06	1.0	2.7
1/13/2012 14:16:00	44.3158	-111.0100	0.7 Mc IE	160.3	4.66	4	241	17.1	0.04	2.7	12.2
1/14/2012 16:20:16	44.6710	-112.1117	2.6 ML IE	125.6	12.77	19	105	24.0	0.03	0.4	1.4
1/14/2012 16:58:54	44.6677	-112.1132	2.3 Mc IE	125.2	15.07	20	104	23.8	0.04	0.3	0.7
1/15/2012 20:23:29	44.5890	-112.3997	1.3 Mc IE	108.9	10.93	10	125	0.6	0.10	0.8	0.8
1/15/2012 21:32:23	42.8607	-111.1615	1.3 ML IE	158.2	11.24	8	213	11.7	0.12	6.1	3.5
1/16/2012 5:48:01	42.8300	-111.2952	1.4 ML IE	151.4	6.70	9	155	17.5	0.06	1.7	5.6
1/16/2012 6:28:19	44.5540	-112.4213	0.9 Mc IE	104.7	2.04	5	134	4.9	0.05	6.9	9.1
1/16/2012 14:07:59	43.3355	-111.0342	1.2 ML IE	145.7	11.08	9	176	15.1	0.03	0.9	2.4
1/16/2012 15:27:20	42.8355	-111.3085	1.0 ML IE	150.1	5.03	5	260	18.7	0.05	2.8	9.9
1/16/2012 16:35:58	44.6528	-112.0322	1.7 Mc IE	126.7	3.84	17	102	29.5	0.03	0.3	0.5
1/16/2012 19:11:30	44.5680	-114.0642	1.3 ML IE	144.7	11.62	8	238	59.7	0.09	1.6	2.1
1/17/2012 6:38:08	44.6692	-112.1117	2.2 Mc IE	125.5	11.27	21	105	24.0	0.04	0.4	1.0
1/18/2012 21:22:05	42.9302	-111.2080	1.0 ML IE	150.8	13.41	6	124	17.5	0.02	0.9	2.6
1/18/2012 22:02:03	42.9315	-111.2097	0.8 ML IE	150.6	11.84	4	198	17.3	0.02	1.2	3.0
1/19/2012 0:10:09	42.8498	-111.2370	1.5 ML IE	153.9	10.99	9	175	14.6	0.06	0.9	2.4
1/19/2012 17:32:02	42.8450	-111.2422	1.1 Mc IE	153.8	12.18	8	179	14.6	0.05	0.9	1.6
1/20/2012 6:28:01	42.8975	-111.5375	1.1 ML IE	131.2	0.03	6	156	10.5	0.09	1.0	1.2
1/20/2012 7:35:30	42.8975	-111.5270	0.8 ML IE	131.9	0.02	5	284	9.7	0.04	1.9	0.8
1/20/2012 11:10:59	44.2915	-114.4710	2.1 Mc IE	153.0	7.02	10	272	81.2	0.11	1.4	4.3
1/21/2012 12:31:07	43.2320	-110.9437	1.2 ML IE	155.9	16.18	10	167	16.3	0.06	1.0	1.0
1/23/2012 5:38:27	44.6248	-112.1370	0.9 Mc IE	120.1	15.58	6	207	20.7	0.06	2.0	1.1
1/23/2012 14:49:24	44.9120	-112.7657	1.8 ML IE	140.4	7.01	9	156	11.4	0.03	1.5	6.3
1/24/2012 17:24:31	44.5445	-112.4460	0.8 ML IE	103.1	1.14	5	180	6.8	0.02	3.1	8.4
1/24/2012 17:24:56	44.5753	-112.4088	0.4 Mc IE	107.2	9.47	6	135	2.3	0.03	2.5	2.8
1/25/2012 4:12:16	43.4550	-111.0437	0.7 Mc IE	142.1	0.25	7	240	8.5	0.03	1.2	1.2
1/25/2012 15:37:54	44.9228	-112.7322	2.2 ML IE	141.7	3.03	11	150	14.0	0.02	1.4	3.2
1/26/2012 0:19:18	44.3830	-112.8462	1.2 Mc IE	81.7	4.63	9	196	34.9	0.10	0.8	1.1

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
1/28/2012 8:14:34	44.5930	-112.4068	1.4 Mc IE	109.1	10.55	12	96	1.0	0.09	0.9	0.7
1/28/2012 8:14:43	44.5822	-112.4018	NM	108.1	11.40	7	173	1.4	0.04	2.4	1.3
1/29/2012 2:01:48	42.7673	-111.4702	0.6 ML IE	145.0	2.47	5	281	19.4	0.11	4.4	15.1
1/29/2012 11:02:29	42.8157	-111.2760	0.9 Mc IE	153.6	13.57	7	208	15.4	0.07	1.8	2.5
1/30/2012 6:21:42	44.3767	-114.0458	1.3 Mc IE	129.5	6.44	10	223	51.6	0.15	1.3	4.2
1/30/2012 14:57:47	44.2287	-114.1098	2.6 Mc MB	124.4	5.65	20	217	57.0	0.06	0.6	2.0
1/30/2012 23:57:01	44.6158	-112.0733	1.9 Mc IE	121.5	12.90	19	94	25.6	0.05	0.3	0.7
1/31/2012 8:07:30	44.5342	-112.2653	0.4 ML IE	106.7	0.03	8	126	12.2	0.19	0.9	2.3
1/31/2012 12:48:13	43.2378	-111.0065	0.9 Mc IE	150.9	2.73	8	147	18.7	0.11	0.9	14.7
2/1/2012 4:46:41	43.7987	-110.9593	1.0 ML IE	147.8	6.71	11	140	11.0	0.08	0.8	1.9
2/1/2012 5:13:29	44.5923	-112.4110	0.5 ML IE	109.0	11.36	7	116	1.3	0.04	1.8	1.4
2/1/2012 7:34:58	44.5930	-112.3918	1.4 Mc MB	109.5	11.03	15	124	0.2	0.06	0.6	0.3
2/1/2012 11:48:17	42.9747	-111.5038	1.5 Mc IE	128.1	6.71	14	176	7.8	0.03	1.1	0.8
2/1/2012 16:51:34	44.5945	-112.6047	1.1 Mc MB	106.0	2.14	6	126	16.7	0.04	4.8	11.5
2/2/2012 1:10:59	44.1965	-112.8828	1.3 Mc IE	61.3	10.35	16	142	14.0	0.06	0.5	1.3
2/2/2012 5:23:37	44.5132	-111.1822	1.7 Mc IE	160.1	16.52	15	162	35.9	0.07	0.5	0.7
2/2/2012 9:38:04	43.3862	-113.5618	1.6 ML IE	69.4	11.00	13	166	8.8	0.08	0.7	1.2
2/2/2012 12:38:42	44.7843	-112.0197	1.0 Mc MB	140.2	5.01	4	137	28.7	0.06	1.2	13.4
2/3/2012 12:13:28	42.8068	-111.2095	0.9 ML IE	158.5	11.85	6	194	10.1	0.04	1.2	2.3
2/4/2012 5:22:40	42.8793	-111.2583	1.4 Mc IE	150.5	10.53	14	103	14.8	0.05	0.5	1.0
2/4/2012 5:29:13	42.8877	-111.2465	1.7 ML IE	150.8	9.66	17	106	15.4	0.06	0.4	1.3
2/4/2012 5:29:29	42.8870	-111.2527	1.4 ML IE	150.4	11.25	6	156	14.9	0.05	0.9	3.7
2/4/2012 7:23:37	43.7232	-110.9278	2.8 ML US	149.7	4.51	28	95	12.4	0.08	0.4	2.9
2/4/2012 7:35:20	43.7213	-110.9228	0.8 Mc IE	150.1	6.44	8	134	12.5	0.06	0.6	3.3
2/4/2012 10:44:14	42.9457	-111.4845	0.8 ML IE	131.3	0.02	7	273	5.2	0.14	2.8	1.4
2/5/2012 7:10:42	43.7252	-110.9233	1.4 Mc IE	150.1	5.27	13	118	12.8	0.08	0.4	3.8
2/5/2012 8:03:52	43.5463	-111.2050	1.2 ML IE	127.9	6.52	10	263	17.6	0.09	1.0	3.8
2/6/2012 1:41:47	44.6550	-112.0988	2.4 Mc IE	124.5	9.56	20	102	24.4	0.12	0.4	2.2
2/6/2012 4:10:50	43.7690	-110.8370	0.4 Mc IE	157.3	8.04	7	162	16.4	0.05	0.9	3.5
2/7/2012 3:09:09	42.9265	-111.4203	1.5 Mc IE	136.7	2.01	13	157	1.3	0.07	1.1	1.0
2/7/2012 3:12:03	42.9133	-111.4767	0.8 ML IE	134.0	1.04	10	267	5.3	0.05	1.5	0.8
2/7/2012 15:16:54	42.9053	-111.4872	0.9 ML IE	133.9	0.18	4	274	6.5	0.09	10.1	5.8
2/7/2012 15:31:32	42.9382	-111.3910	1.4 ML IE	137.9	0.02	13	97	2.5	0.08	1.0	2.4
2/7/2012 16:28:14	42.9255	-111.4367	1.2 ML IE	135.7	3.07	10	144	1.9	0.08	1.1	0.7
2/7/2012 16:53:07	44.6190	-112.0737	0.9 ML IE	121.8	13.15	10	138	25.6	0.02	0.6	2.0
2/8/2012 4:16:22	44.6225	-112.0653	1.7 Mc IE	122.5	9.24	17	95	26.3	0.06	0.3	1.8
2/8/2012 10:28:09	44.4422	-112.8463	0.9 Mc IE	88.3	10.00	8	107	39.7	0.10	0.8	13.1
2/9/2012 8:55:52	44.6713	-114.1955	1.6 Mc IE	160.2	8.95	7	294	74.5	0.06	11.2	3.0
2/9/2012 20:00:26	43.4640	-111.0123	0.9 Mc IE	144.5	6.63	9	227	5.8	0.10	1.5	1.1
2/9/2012 20:03:05	43.2673	-111.2302	1.2 ML IE	132.6	12.42	13	172	26.4	0.08	0.9	3.4
2/10/2012 18:47:35	42.7187	-111.7435	1.1 ML IE	133.7	9.16	8	106	35.9	0.07	0.8	5.5
2/11/2012 2:46:35	42.7332	-111.7228	0.8 ML IE	133.5	4.98	5	111	45.8	0.12	0.9	15.0
2/11/2012 4:50:10	42.9667	-111.6103	0.7 Mc IE	121.7	3.81	7	284	15.7	0.05	5.8	9.4
2/11/2012 19:19:04	44.4718	-112.9017	1.6 Mc IE	91.9	6.63	10	119	39.8	0.09	0.6	13.1
2/11/2012 19:31:06	44.4658	-112.8953	1.3 Mc IE	91.2	8.83	9	117	40.4	0.06	0.6	12.9
2/12/2012 2:29:48	43.5108	-111.1110	0.0 Mc IE	135.9	4.00	5	249	13.2	0.08	3.2	11.3
2/12/2012 6:06:32	44.2383	-114.0323	1.2 ML IE	119.7	5.34	10	212	50.7	0.12	1.6	6.1
2/12/2012 6:59:17	43.2117	-110.9255	1.0 Mc IE	158.0	3.37	6	215	17.8	0.12	1.7	13.4
2/13/2012 1:10:46	44.6375	-112.5118	1.5 Mc IE	112.0	15.01	7	132	10.5	0.03	1.0	1.5

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
2/13/2012 12:27:17	42.6453	-111.6935	1.1 ML IE	142.6	6.33	10	114	39.4	0.10	0.6	12.3
2/13/2012 15:11:32	44.1893	-114.3920	2.1 Mc IE	142.4	11.18	8	258	69.7	0.11	1.2	4.4
2/13/2012 21:04:58	44.6982	-111.8515	1.9 Mc MB	138.4	5.05	11	114	15.1	0.02	1.1	2.0
2/14/2012 7:22:27	44.7160	-111.8445	1.6 Mc MB	140.3	9.43	9	122	14.3	0.05	1.2	2.4
2/14/2012 18:40:34	43.8493	-113.6173	0.7 Mc IE	70.7	6.20	8	201	16.0	0.05	1.6	1.2
2/15/2012 3:03:08	44.4803	-113.9572	0.9 ML IE	131.8	6.75	7	225	73.4	0.10	1.0	4.2
2/15/2012 16:22:07	44.4672	-112.8970	1.2 ML IE	91.4	2.17	5	152	40.2	0.01	0.7	2.3
2/15/2012 18:16:14	44.4773	-112.8797	1.2 Mc IE	92.4	7.58	5	156	39.0	0.12	0.8	15.7
2/16/2012 9:09:52	43.3128	-111.5350	0.2 ML IE	107.7	12.29	8	241	31.8	0.06	0.9	2.0
2/16/2012 9:33:09	43.3170	-111.5763	1.0 ML IE	104.4	3.23	11	138	33.7	0.16	1.4	17.6
2/17/2012 0:42:05	44.4783	-112.6167	1.4 Mc IE	93.1	7.72	6	160	21.8	0.04	1.3	12.9
2/17/2012 5:16:39	42.5487	-111.8847	0.7 Mc IE	142.7	5.00	4	116	48.7	0.02	1.1	12.5
2/17/2012 12:39:30	43.2312	-110.9215	0.8 Mc IE	157.7	1.96	10	165	15.6	0.12	1.1	1.6
2/17/2012 21:22:00	43.3568	-111.2062	0.5 ML IE	131.6	5.08	6	291	25.5	0.11	2.0	13.9
2/18/2012 1:10:40	43.3597	-111.0793	0.9 ML IE	141.5	15.19	6	332	17.8	0.05	2.8	1.8
2/18/2012 2:41:49	43.3898	-111.1360	1.0 ML IE	136.2	0.11	10	181	18.7	0.12	1.0	3.2
2/18/2012 21:24:32	43.2282	-110.9233	1.0 Mc IE	157.6	6.82	7	212	16.0	0.08	1.4	3.8
2/19/2012 22:42:57	43.0800	-111.4587	1.8 Mc IE	124.6	5.53	14	129	7.8	0.09	0.7	1.0
2/19/2012 23:02:17	43.0837	-111.4652	2.1 ML IE	124.0	5.71	22	91	8.4	0.14	0.6	1.5
2/20/2012 4:17:39	44.5845	-112.4197	1.7 Mc IE	108.0	10.10	17	73	2.2	0.10	0.4	0.5
2/20/2012 11:20:14	43.1358	-111.1902	0.7 ML IE	141.1	3.58	8	134	17.3	0.11	0.9	11.2
2/20/2012 11:41:55	44.6658	-112.1100	1.5 Mc IE	125.2	12.46	12	104	24.0	0.06	0.5	1.7
2/20/2012 22:53:43	42.6150	-111.4088	1.2 Mc IE	160.5	5.86	8	123	30.3	0.04	0.8	6.9
2/20/2012 23:38:26	42.8778	-111.4452	2.1 Mc IE	138.4	0.03	13	157	7.0	0.17	0.9	1.1
2/21/2012 15:01:21	43.0795	-111.4293	1.4 ML IE	126.7	7.20	9	210	5.6	0.04	1.6	1.0
2/21/2012 18:39:13	43.1443	-111.4760	NM	119.9	4.60	3	330	13.3	0.18	5.4	7.8
2/21/2012 18:39:17	43.1475	-111.4688	1.4 ML IE	120.2	2.49	4	332	13.2	0.03	3.1	10.7
2/22/2012 1:41:14	44.6493	-112.0025	1.0 ML IE	127.5	10.24	5	172	28.2	0.04	1.4	7.9
2/22/2012 21:02:49	44.3115	-113.1712	2.1 ML IE	79.9	5.83	21	111	18.7	0.08	0.4	1.0
2/23/2012 9:59:01	44.6177	-112.3988	1.0 Mc IE	112.0	13.80	5	299	2.7	0.01	4.9	0.9
2/23/2012 14:06:35	43.3683	-110.8545	0.2 ML IE	159.0	8.28	8	169	0.7	0.10	0.9	1.5
2/25/2012 0:45:51	43.0702	-111.4373	0.8 Mc IE	126.7	1.58	6	212	5.8	0.03	2.0	1.1
2/26/2012 4:31:35	43.2730	-111.2540	0.6 ML IE	130.6	5.01	6	182	26.2	0.06	1.0	10.4
2/26/2012 8:27:46	43.3128	-110.9837	0.8 ML IE	150.3	2.12	9	166	12.0	0.19	0.8	20.2
2/26/2012 8:27:53	43.3192	-110.9903	0.6 ML IE	149.6	6.18	6	180	12.2	0.05	0.8	4.1
2/26/2012 8:33:27	43.3313	-110.9693	0.9 ML IE	150.9	2.49	9	163	10.1	0.14	1.0	14.5
2/26/2012 8:33:44	43.3100	-110.9690	0.8 ML IE	151.5	3.58	8	162	11.1	0.07	0.6	5.1
2/27/2012 17:19:59	42.9472	-111.5017	1.0 ML IE	130.1	0.02	5	281	6.6	0.06	2.8	0.9
2/27/2012 20:04:20	44.5700	-112.0493	0.9 Mc IE	118.0	6.48	4	155	27.5	0.05	2.0	11.5
3/1/2012 1:36:47	42.8717	-111.5397	1.0 ML IE	133.0	2.18	6	277	12.1	0.07	1.6	13.5
3/5/2012 5:18:02	44.3493	-112.8648	2.1 Mc IE	78.1	8.44	17	96	31.0	0.12	0.4	7.0
3/5/2012 10:52:20	44.2635	-114.0960	1.0 ML IE	125.5	6.98	7	246	55.4	0.07	1.2	5.1
3/5/2012 11:46:35	43.2828	-110.9018	1.2 Mc IE	157.5	11.34	7	163	9.7	0.08	1.5	1.6
3/6/2012 19:30:09	43.3138	-111.5365	0.6 ML IE	107.5	5.08	5	254	31.9	0.25	3.7	21.8
3/7/2012 5:02:37	43.8423	-110.9295	0.1 Mc IE	150.7	8.15	6	190	6.1	0.05	3.5	2.1
3/7/2012 9:44:22	43.8505	-111.0413	0.2 ML IE	142.0	3.22	7	240	9.7	0.07	1.3	8.2
3/7/2012 12:26:55	44.9107	-111.8593	1.2 Mc MB	158.4	5.17	9	190	25.3	0.05	0.6	12.9
3/7/2012 12:27:10	44.9132	-111.8705	1.3 ML IE	158.3	9.37	9	189	26.0	0.00	0.6	1.7
3/7/2012 22:59:30	44.3417	-112.5537	0.6 ML IE	79.1	5.51	4	184	18.9	0.04	3.7	8.5

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
3/9/2012 0:49:35	43.3018	-111.0915	0.5 Mc IE	142.2	5.15	8	297	20.6	0.20	1.8	12.3
3/9/2012 1:08:34	42.9092	-111.2670	3.0 Mc MB	148.1	11.13	27	105	13.0	0.20	0.4	1.1
3/9/2012 20:23:42	42.8810	-111.3002	0.8 ML IE	147.6	10.90	7	175	11.8	0.05	1.4	2.9
3/9/2012 20:47:56	42.8890	-111.2923	1.1 Mc IE	147.6	12.02	10	167	11.9	0.09	1.3	2.3
3/9/2012 22:17:38	42.8945	-111.2725	1.0 ML IE	148.6	9.71	12	157	13.1	0.06	0.6	2.0
3/9/2012 23:54:56	43.6432	-111.0438	0.8 Mc IE	140.3	11.99	7	197	1.5	0.02	2.0	0.9
3/10/2012 15:54:12	42.8763	-111.2962	0.4 ML IE	148.2	11.32	4	177	12.3	0.01	2.4	3.9
3/10/2012 17:12:11	42.8975	-111.2652	1.9 Mc IE	148.9	9.35	19	132	13.5	0.08	0.7	2.2
3/11/2012 5:13:36	43.1315	-110.9655	0.9 Mc IE	158.1	2.92	11	168	27.3	0.04	0.8	12.0
3/13/2012 9:09:51	42.8977	-111.2793	1.8 ML IE	148.0	11.76	16	101	12.4	0.07	0.4	0.9
3/14/2012 17:29:14	42.8708	-111.3018	0.8 ML IE	148.2	13.89	9	183	12.3	0.05	1.4	2.0
3/15/2012 18:44:13	44.4948	-114.2947	1.3 ML IE	153.2	3.09	5	246	73.8	0.04	2.1	4.3
3/16/2012 15:02:27	44.7223	-112.5163	1.6 Mc IE	121.2	3.96	9	210	17.3	0.06	8.0	7.7
3/16/2012 17:23:55	42.8945	-111.2797	1.8 ML IE	148.1	11.30	12	159	12.6	0.07	0.8	2.0
3/17/2012 2:34:51	43.6560	-110.9212	0.2 ML IE	150.1	11.32	6	103	8.7	0.18	0.9	2.7
3/17/2012 4:59:43	44.4040	-111.1090	0.6 ML IE	158.2	13.97	7	257	24.5	0.06	3.2	1.2
3/17/2012 9:54:58	43.1180	-110.9502	1.0 Mc IE	159.8	12.23	10	172	28.3	0.08	0.9	2.3
3/17/2012 11:06:38	43.2840	-111.4105	0.0 ML IE	118.2	5.15	6	246	25.8	0.15	2.4	14.6
3/17/2012 14:20:20	43.8208	-114.7160	1.3 Mc IE	156.8	5.92	9	208	98.9	0.11	1.5	4.8
3/18/2012 22:33:19	42.9008	-111.2697	2.4 Mc IE	148.4	6.29	18	103	13.1	0.07	0.4	1.9
3/19/2012 6:58:42	44.3750	-114.4628	1.1 Mc IE	156.9	4.96	8	250	84.6	0.06	1.3	3.9
3/19/2012 12:07:57	42.8965	-111.2817	1.2 ML IE	147.9	11.18	10	135	12.3	0.08	0.7	1.8
3/20/2012 3:42:11	44.1477	-113.1010	0.1 ML IE	61.0	6.67	6	153	24.7	0.04	0.6	13.0
3/20/2012 20:16:29	43.7990	-114.7275	1.6 ML IE	157.5	2.80	12	176	36.9	0.03	1.3	2.1
3/20/2012 23:48:03	43.3432	-110.9587	0.8 ML IE	151.4	3.85	5	275	8.9	0.06	2.9	10.2
3/20/2012 23:48:25	43.3693	-110.9668	0.4 ML IE	150.1	3.76	5	257	9.3	0.03	3.8	12.1
3/21/2012 1:55:40	43.4835	-110.8073	0.8 ML IE	160.6	2.06	9	147	11.6	0.08	0.6	14.2
3/21/2012 22:49:01	44.2027	-114.5825	1.4 ML IE	157.0	0.05	15	205	72.5	0.04	1.3	1.8
3/22/2012 23:08:30	42.9003	-111.2798	1.3 ML IE	147.8	10.29	9	155	12.3	0.05	0.9	2.6
3/22/2012 23:30:13	43.6665	-111.1277	0.5 ML IE	133.5	1.51	5	210	8.7	0.05	1.5	4.4
3/23/2012 15:44:40	43.7867	-114.7715	1.3 Mc IE	160.9	5.57	9	311	38.6	0.02	4.1	8.3
3/24/2012 5:53:12	43.1858	-111.0220	0.2 ML IE	151.6	13.06	5	208	24.0	0.01	2.0	3.2
3/24/2012 9:36:49	44.4637	-112.7465	0.6 Mc IE	90.6	6.94	9	96	31.5	0.14	0.6	16.8
3/26/2012 13:55:26	43.0407	-111.4025	0.9 ML IE	130.8	3.93	9	193	3.0	0.04	0.9	0.7
3/28/2012 3:43:47	44.6237	-112.1250	1.3 Mc MB	120.4	8.80	16	95	21.6	0.07	0.4	1.9
3/28/2012 9:39:08	43.7063	-111.0300	0.3 Mc IE	141.4	3.56	9	170	7.6	0.04	0.7	3.2
3/28/2012 16:16:52	42.6860	-111.7098	0.8 Mc IE	138.2	4.46	6	212	49.4	0.06	0.9	6.6
3/29/2012 1:03:38	43.3258	-110.9023	1.4 ML IE	156.3	3.90	15	150	5.8	0.10	0.5	1.7
3/29/2012 4:11:17	42.7817	-111.3198	0.7 ML IE	153.1	3.54	4	258	18.1	0.02	2.1	9.2
3/29/2012 4:51:59	43.8503	-110.8308	0.6 ML IE	158.7	6.08	7	181	10.1	0.05	0.8	3.4
3/30/2012 5:17:00	42.9195	-111.3512	0.4 ML IE	141.8	3.73	7	161	6.1	0.06	1.4	5.4
3/30/2012 6:05:02	43.4675	-110.8993	0.0 Mc IE	153.5	3.83	5	189	4.9	0.04	9.0	8.7
3/30/2012 9:26:46	44.8297	-112.5393	1.3 Mc MB	132.7	12.68	11	160	24.5	0.05	0.5	0.8
3/31/2012 9:34:52	43.7713	-111.0135	0.6 Mc IE	143.2	2.50	9	159	14.8	0.09	0.8	11.5
3/31/2012 20:03:14	43.2472	-110.9098	0.6 ML IE	158.0	2.03	9	166	13.6	0.08	0.9	14.2
4/1/2012 18:25:31	44.2095	-112.5323	1.3 Mc IE	65.4	11.23	14	143	17.4	0.08	0.6	1.1
4/2/2012 7:58:42	42.5723	-111.4803	2.0 Mc IE	160.0	10.55	19	108	37.8	0.02	0.6	1.2
4/2/2012 9:42:25	42.5915	-111.4510	0.9 ML IE	160.0	4.90	8	167	34.6	0.07	2.3	10.0
4/2/2012 10:41:44	44.6357	-112.0417	1.1 Mc MB	124.7	6.69	6	151	28.4	0.07	0.8	12.4

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
4/3/2012 5:03:24	43.7732	-110.8408	0.0 ML IE	157.1	8.26	7	161	15.9	0.03	0.6	3.1
4/4/2012 17:54:29	42.7615	-111.3387	1.9 ML IE	153.4	2.28	14	122	19.5	0.06	0.9	11.6
4/4/2012 18:02:07	42.7763	-111.2822	1.3 ML IE	155.9	10.35	12	137	14.9	0.03	0.6	1.0
4/4/2012 18:06:53	42.7108	-111.3603	0.6 ML IE	155.8	4.97	6	285	22.1	0.05	2.3	9.6
4/4/2012 18:22:56	42.7643	-111.3335	3.2 ML IE	153.5	9.94	29	85	19.1	0.06	0.5	0.7
4/5/2012 14:09:02	44.1185	-113.9705	0.9 Mc IE	108.7	8.82	11	198	46.6	0.05	0.9	4.0
4/7/2012 0:09:53	43.5158	-110.9750	0.2 ML IE	146.7	9.04	7	194	3.5	0.03	1.0	1.7
4/7/2012 1:14:22	43.8085	-111.2177	1.1 ML IE	127.3	11.72	10	214	24.4	0.05	1.0	2.2
4/8/2012 21:33:30	44.6568	-112.5057	0.5 ML IE	114.2	2.03	7	136	11.3	0.02	0.6	0.9
4/9/2012 0:10:28	43.2922	-111.3785	0.5 Mc IE	120.4	2.50	9	190	26.5	0.10	1.0	14.9
4/9/2012 0:15:52	43.2918	-111.3885	0.5 Mc IE	119.6	2.49	8	212	26.5	0.20	1.3	20.4
4/9/2012 10:50:22	44.6813	-113.2390	1.3 Mc MB	120.4	7.59	8	224	34.9	0.07	1.2	12.5
4/9/2012 15:52:48	42.8933	-111.2718	0.6 ML IE	148.7	2.44	10	158	13.2	0.09	0.5	14.0
4/10/2012 0:05:35	42.5877	-111.5010	1.4 Mc IE	157.6	9.77	13	104	38.3	0.09	0.5	2.3
4/10/2012 0:09:54	42.5967	-111.4842	1.3 ML IE	157.8	8.26	13	104	36.6	0.12	0.6	3.9
4/10/2012 0:55:25	42.5783	-111.5078	1.5 ML IE	158.0	2.35	15	134	39.3	0.06	0.6	12.4
4/11/2012 22:04:11	43.7057	-111.0392	0.4 ML IE	140.7	5.43	5	208	7.6	0.01	1.9	4.4
4/12/2012 12:11:12	42.7022	-111.6232	0.7 ML IE	141.4	5.00	8	192	30.9	0.04	0.7	10.9
4/13/2012 10:39:49	44.6885	-112.4990	1.5 Mc MB	117.7	14.58	12	90	13.4	0.05	0.7	0.9
4/14/2012 4:30:59	42.6160	-111.6665	1.3 Mc IE	146.5	4.05	12	120	49.3	0.10	0.6	14.1
4/14/2012 7:37:42	42.9617	-111.4552	0.7 ML IE	132.1	0.17	10	130	3.8	0.06	0.8	0.7
4/14/2012 10:01:56	44.0148	-114.6225	1.6 Mc IE	153.4	6.83	12	270	53.2	0.09	2.0	4.2
4/14/2012 10:57:28	42.8985	-111.2707	1.0 ML IE	148.5	4.80	10	154	13.1	0.08	1.1	8.3
4/14/2012 11:53:48	43.1968	-111.4865	0.6 ML IE	116.4	6.45	6	263	18.5	0.01	1.8	4.6
4/14/2012 17:41:20	42.9128	-111.5718	0.7 ML IE	128.0	2.86	5	294	12.6	0.08	2.2	11.0
4/14/2012 19:58:11	42.8830	-111.6753	1.9 ML IE	123.9	3.84	15	164	21.6	0.06	0.5	4.9
4/14/2012 20:23:12	42.8767	-111.6303	1.7 ML IE	127.1	6.66	13	116	18.4	0.05	0.6	2.2
4/14/2012 20:25:01	42.8228	-111.6423	1.1 ML IE	130.6	7.21	6	222	22.1	0.04	2.3	3.0
4/14/2012 20:25:42	42.8953	-111.5668	0.7 ML IE	129.6	6.29	5	158	12.8	0.02	1.0	3.5
4/14/2012 20:27:26	42.8730	-111.6658	1.3 Mc IE	125.3	2.34	12	166	21.2	0.07	0.6	11.8
4/14/2012 20:29:20	42.9032	-111.6048	0.9 ML IE	126.7	2.69	11	118	15.5	0.09	0.6	10.4
4/14/2012 20:31:23	42.8725	-111.6740	1.7 ML IE	124.8	5.37	15	167	21.9	0.06	0.6	3.1
4/14/2012 20:46:21	42.8663	-111.6725	1.6 Mc IE	125.4	2.54	13	111	22.0	0.04	0.5	10.4
4/14/2012 22:08:28	42.8850	-111.6668	1.1 Mc IE	124.3	2.02	9	164	20.9	0.08	0.8	14.2
4/15/2012 1:19:53	42.8793	-111.6852	0.9 Mc IE	123.6	3.33	8	166	22.5	0.06	0.8	10.2
4/15/2012 3:44:25	42.8643	-111.6575	0.9 ML IE	126.4	3.84	11	168	20.9	0.03	0.9	7.3
4/17/2012 7:05:11	44.2650	-114.2150	1.6 Mc IE	133.7	1.45	9	227	71.6	0.07	1.6	2.4
4/17/2012 9:07:44	43.3237	-111.3057	1.3 Mc IE	124.8	2.09	15	81	30.5	0.07	0.7	13.8
4/17/2012 17:03:03	42.9728	-111.4403	0.7 ML IE	132.4	7.76	7	226	4.2	0.08	2.0	1.9
4/18/2012 3:16:44	43.4110	-110.9007	0.6 ML IE	154.4	13.69	7	143	6.7	0.05	1.6	0.7
4/18/2012 10:30:31	44.5760	-112.9640	2.0 Mc MB	104.0	9.30	25	169	29.4	0.09	0.4	2.6
4/19/2012 11:28:42	43.1740	-111.3947	0.7 Mc IE	124.2	3.39	10	197	13.5	0.04	1.1	6.8
4/19/2012 21:13:27	42.5967	-111.4290	0.8 ML IE	160.8	4.76	6	305	32.8	0.05	2.0	5.3
4/20/2012 4:18:16	42.9288	-111.5068	0.5 ML IE	131.0	7.05	6	280	7.0	0.02	1.7	1.2
4/20/2012 7:53:52	44.6002	-112.0920	1.5 Mc MB	119.3	6.02	16	132	24.0	0.07	0.6	11.5
4/21/2012 6:21:03	44.7463	-111.8810	1.6 Mc MB	141.7	4.96	21	135	17.2	0.09	0.6	1.4
4/21/2012 8:10:37	44.6243	-113.8952	0.8 Mc IE	140.2	3.10	6	234	52.3	0.10	1.8	6.1
4/22/2012 6:21:36	43.5607	-110.9657	0.2 Mc IE	147.0	6.48	10	160	7.9	0.04	0.8	1.8
4/22/2012 22:09:59	43.7877	-110.9750	0.9 Mc IE	146.4	3.55	9	145	12.5	0.03	0.7	6.5

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
4/22/2012 22:13:13	43.7877	-110.9748	2.4 Mc IE	146.4	3.28	34	97	12.5	0.06	0.4	4.0
4/22/2012 22:22:43	43.7882	-110.9750	2.5 ML IE	146.4	2.49	39	97	12.4	0.05	0.4	7.4
4/22/2012 22:30:34	43.7880	-110.9728	2.0 ML IE	146.6	1.94	36	98	12.4	0.06	0.5	1.7
4/22/2012 22:33:17	43.7893	-110.9810	0.9 Mc IE	146.0	1.17	8	148	12.4	0.04	1.0	2.8
4/22/2012 23:36:30	43.7917	-110.9957	0.3 Mc IE	144.8	2.19	6	192	12.6	0.03	3.3	12.7
4/22/2012 23:48:59	43.7890	-110.9740	1.0 ML IE	146.5	3.82	10	145	12.3	0.07	0.7	5.1
4/23/2012 2:02:26	43.7838	-110.9758	0.3 Mc IE	146.3	2.50	9	145	12.9	0.06	0.8	11.3
4/23/2012 3:47:59	43.7885	-110.9790	0.3 Mc IE	146.1	2.07	9	146	12.5	0.03	0.7	12.8
4/23/2012 18:16:35	44.1270	-114.3112	1.3 Mc IE	133.7	4.13	11	246	63.2	0.03	1.9	5.1
4/25/2012 5:58:29	44.6205	-112.6285	1.5 Mc MB	108.7	5.50	16	102	18.8	0.06	0.6	1.0
4/25/2012 6:59:20	43.5165	-111.2395	0.6 ML IE	125.5	6.03	8	271	21.9	0.07	1.8	5.8
4/25/2012 8:01:05	43.3417	-110.9402	1.5 ML IE	152.9	6.42	11	121	7.5	0.03	0.5	1.4
4/25/2012 8:01:43	43.3335	-110.9450	0.9 ML IE	152.7	6.90	9	157	8.2	0.05	0.7	1.5
4/25/2012 14:47:59	44.3602	-114.0135	1.3 Mc IE	126.4	0.15	13	259	65.7	0.08	1.7	3.4
4/25/2012 17:34:31	44.3332	-113.9465	2.2 Mc MB	120.3	0.19	14	273	43.3	0.05	1.5	2.0
4/26/2012 8:10:44	43.3258	-111.2923	0.6 ML IE	125.8	4.99	7	199	30.9	0.08	1.0	11.4
4/26/2012 21:32:55	43.3358	-110.9235	0.4 ML IE	154.3	9.07	6	284	6.5	0.07	1.6	2.6
4/26/2012 22:30:41	42.5333	-111.5978	1.5 ML IE	157.3	3.54	11	97	48.3	0.06	0.4	11.7
4/26/2012 22:35:12	42.5222	-111.6235	2.0 Mc IE	157.0	3.54	16	95	46.9	0.06	0.6	11.6
4/27/2012 6:50:15	44.6152	-112.1832	1.2 Mc MB	117.6	5.20	7	141	32.3	0.13	1.0	4.9
4/28/2012 8:32:21	43.6460	-110.8120	0.1 ML IE	158.9	2.50	7	122	17.2	0.10	0.7	14.1
4/28/2012 17:43:07	43.6477	-110.8120	0.4 ML IE	158.9	3.09	7	123	17.3	0.04	0.7	11.2
4/28/2012 17:46:49	43.6407	-110.8127	0.2 Mc IE	158.9	2.49	5	170	17.2	0.02	1.1	12.4
4/28/2012 20:31:20	42.8572	-111.2100	1.1 ML IE	155.2	4.89	8	160	13.6	0.06	1.7	11.8
4/29/2012 4:05:30	44.5868	-113.8578	1.9 Mc MB	135.1	3.61	13	292	80.0	0.13	1.7	3.1
4/29/2012 4:07:17	44.5975	-113.8687	1.8 Mc MB	136.6	1.31	13	292	81.4	0.14	1.9	3.3
4/29/2012 4:35:44	44.5872	-113.8650	1.3 Mc IE	135.5	0.04	9	309	80.3	0.08	3.0	4.6
4/30/2012 2:31:37	44.3683	-112.6805	1.3 Mc IE	80.3	3.68	15	223	29.1	0.08	0.7	1.1
4/30/2012 5:47:41	44.3462	-112.6522	0.8 ML IE	78.2	3.69	14	216	26.7	0.04	0.9	1.1
4/30/2012 19:03:58	43.9320	-114.0485	1.4 ML IE	106.5	8.31	10	234	47.9	0.03	1.1	12.5
5/1/2012 5:29:29	43.6127	-110.8353	0.5 ML IE	157.2	7.13	9	104	15.7	0.06	0.4	2.9
5/2/2012 11:11:22	44.6095	-112.1647	1.2 Mc MB	117.7	15.22	8	245	32.2	0.07	1.4	0.7
5/2/2012 14:14:57	43.5082	-111.0713	1.0 ML IE	139.1	10.32	11	222	10.0	0.10	1.0	1.2
5/2/2012 14:32:38	42.7047	-111.4272	0.9 ML IE	152.3	2.56	11	143	25.9	0.07	0.9	12.7
5/2/2012 15:21:50	42.6985	-111.7648	1.1 ML IE	134.4	7.77	10	97	38.7	0.07	0.5	4.2
5/3/2012 3:25:19	42.6813	-111.7042	0.6 Mc IE	138.9	5.00	8	213	49.5	0.05	1.3	12.9
5/3/2012 6:36:44	42.7082	-111.4158	1.1 Mc IE	152.7	5.97	12	129	25.5	0.04	0.4	4.3
5/4/2012 2:45:32	43.0577	-111.1667	0.5 ML IE	146.6	5.07	6	134	16.6	0.06	0.8	9.6
5/4/2012 2:47:24	43.0648	-111.1905	0.8 ML IE	144.5	16.15	8	128	14.7	0.03	0.5	1.0
5/6/2012 9:12:51	42.8477	-111.2633	0.6 Mc IE	152.3	10.45	7	184	16.2	0.03	1.8	4.4
5/6/2012 9:40:38	42.8522	-111.2612	0.5 ML IE	152.1	4.83	6	181	16.2	0.02	1.9	11.9
5/6/2012 20:20:00	43.3487	-111.1533	1.0 ML IE	135.9	6.66	10	166	22.7	0.07	0.6	7.1
5/8/2012 14:25:17	43.1415	-110.9467	0.6 ML IE	159.1	7.98	10	170	25.7	0.04	0.9	4.5
5/8/2012 19:35:18	44.6030	-112.1062	0.9 Mc MB	119.0	4.01	8	133	22.9	0.08	1.0	1.8
5/9/2012 15:44:46	44.6262	-112.1242	1.3 Mc MB	120.7	5.37	11	140	21.8	0.01	0.5	12.4
5/9/2012 21:27:42	42.7383	-111.7253	1.5 ML IE	132.9	8.02	8	132	45.5	0.02	0.8	11.5
5/10/2012 6:45:23	43.4120	-110.8865	1.0 ML IE	155.5	0.92	10	136	6.2	0.07	0.9	2.0
5/11/2012 10:38:10	42.8862	-111.2088	0.9 ML IE	153.4	10.26	12	143	16.1	0.06	0.7	2.5
5/11/2012 16:40:55	44.5882	-112.4540	1.4 Mc MB	107.6	2.62	10	131	4.8	0.05	1.1	1.7

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
5/11/2012 17:48:01	44.6327	-112.3772	0.9 Mc MB	114.0	5.77	6	230	4.6	0.02	2.2	0.4
5/12/2012 4:35:47	44.3953	-114.2013	1.1 Mc IE	140.7	5.03	8	273	79.3	0.06	2.2	3.7
5/12/2012 21:22:10	43.3770	-110.8705	0.2 Mc IE	157.5	7.88	7	196	2.2	0.04	1.5	2.3
5/13/2012 12:55:39	43.8755	-111.0250	0.3 Mc IE	143.7	4.85	9	160	7.3	0.05	0.8	2.5
5/14/2012 16:14:26	43.4320	-110.8865	1.3 ML IE	155.1	8.59	9	164	8.2	0.08	2.0	1.5
5/15/2012 3:10:38	43.1573	-111.2972	0.6 ML IE	132.2	2.44	9	156	13.0	0.08	0.9	12.7
5/16/2012 14:12:04	45.0203	-112.7187	1.5 Mc MB	152.5	5.90	8	264	23.7	0.01	7.1	6.4
5/17/2012 10:38:21	42.8602	-111.3158	0.6 ML IE	148.0	2.18	7	196	12.2	0.05	0.8	12.9
5/17/2012 10:41:32	42.8637	-111.3108	0.5 ML IE	148.1	6.65	7	191	12.2	0.04	1.2	4.7
5/18/2012 15:05:49	44.6120	-112.5938	0.9 Mc MB	108.1	6.33	6	137	16.0	0.06	0.9	10.9
5/20/2012 22:15:35	43.6277	-110.8950	0.7 ML IE	152.3	5.51	9	100	10.7	0.02	0.4	3.0
5/21/2012 12:36:49	44.6833	-113.9542	1.0 Mc IE	148.3	7.42	8	242	89.0	0.04	1.3	1.7
5/22/2012 7:55:39	44.4552	-114.2255	1.2 ML IE	146.2	13.35	8	222	85.1	0.02	1.0	3.9
5/22/2012 14:24:44	42.9365	-111.2083	1.3 ML IE	150.4	9.21	12	123	17.4	0.04	0.5	2.8
5/23/2012 10:09:07	42.6447	-111.4350	1.2 ML IE	156.6	2.77	14	104	30.5	0.06	0.5	10.2
5/24/2012 21:47:29	44.6473	-112.9292	1.3 Mc IE	111.6	5.14	8	169	21.0	0.02	1.6	4.1
5/27/2012 13:39:44	44.6572	-112.3325	1.7 Mc MB	117.7	4.11	12	145	8.6	0.03	0.9	0.6
5/28/2012 16:35:55	44.3110	-112.6955	0.9 Mc MB	73.9	2.11	11	139	24.3	0.05	0.6	1.0
5/28/2012 20:58:31	43.1695	-110.9870	0.5 ML IE	154.9	10.97	9	165	24.1	0.02	0.8	3.5
5/29/2012 8:30:47	44.0548	-114.4537	1.8 Mc MB	141.6	3.41	16	254	54.8	0.06	0.9	2.9
5/29/2012 14:23:27	44.2572	-114.0808	1.7 Mc MB	124.1	6.87	14	217	54.3	0.05	0.6	2.5
5/29/2012 14:28:32	44.2542	-114.0288	1.4 ML IE	120.5	4.91	6	288	50.2	0.06	4.9	10.1
5/30/2012 11:04:22	44.3095	-112.7058	0.6 Mc IE	73.6	2.33	6	136	24.2	0.03	0.9	2.4
5/31/2012 21:40:01	43.4268	-110.8843	0.4 ML IE	155.4	8.44	7	164	7.6	0.03	0.8	2.3
6/1/2012 17:59:53	43.4105	-111.1138	1.9 ML IE	137.5	9.87	16	93	15.9	0.06	0.4	1.5
6/2/2012 11:26:14	44.7030	-112.4787	1.5 Mc MB	119.7	6.06	21	125	13.9	0.03	0.5	6.2
6/3/2012 7:09:59	42.8647	-111.3072	0.5 ML IE	148.3	9.08	6	189	12.4	0.12	2.8	6.6
6/4/2012 3:00:16	43.4725	-110.8715	0.4 ML IE	155.6	14.41	7	118	6.7	0.04	0.9	3.0
6/6/2012 3:14:34	43.7607	-114.7417	1.7 Mc MB	158.3	3.40	13	172	34.9	0.04	1.0	1.9
6/6/2012 8:02:57	43.7485	-114.7400	1.6 ML IE	158.1	2.79	8	190	33.9	0.03	1.5	2.2
6/6/2012 8:06:30	43.7710	-114.7315	2.1 ML IE	157.5	7.05	9	192	35.0	0.02	1.0	9.7
6/7/2012 2:32:57	44.6850	-114.0880	2.2 Mc MB	155.4	0.02	16	128	98.2	0.13	0.9	2.3
6/8/2012 6:35:03	43.1777	-110.9275	0.4 ML IE	159.1	3.30	6	222	21.4	0.02	2.2	11.0
6/8/2012 13:05:14	43.4152	-110.8813	0.7 ML IE	155.9	8.18	8	161	6.3	0.05	1.2	1.6
6/8/2012 14:13:57	44.6488	-114.0227	0.6 ML IE	148.9	0.16	8	242	61.8	0.13	1.9	9.1
6/10/2012 5:08:44	44.2412	-114.0257	2.0 Mc MB	119.5	4.15	14	211	50.1	0.09	0.8	3.0
6/11/2012 22:53:10	43.1727	-110.9135	1.0 ML IE	160.4	5.08	11	172	21.7	0.03	1.0	5.5
6/12/2012 19:52:35	43.9315	-113.6917	0.3 ML IE	79.5	1.84	8	153	19.3	0.02	0.9	2.6
6/13/2012 6:58:55	44.6832	-113.6687	1.3 Mc MB	135.0	0.04	8	229	46.4	0.05	2.0	1.8
6/14/2012 13:29:26	44.7615	-113.0945	1.0 Mc MB	126.1	5.23	6	222	20.8	0.06	5.5	12.2
6/14/2012 14:30:08	44.7285	-111.7922	1.3 Mc MB	143.8	3.48	11	130	10.0	0.02	0.6	1.2
6/15/2012 10:39:59	44.2788	-114.1105	1.0 Mc IE	127.4	6.38	10	249	56.4	0.05	1.0	3.4
6/15/2012 21:35:18	44.2887	-114.1103	0.6 ML IE	128.0	7.47	8	250	56.3	0.04	1.1	12.9
6/16/2012 17:34:32	44.2557	-113.8155	1.2 Mc IE	106.8	1.67	9	298	33.3	0.05	1.8	2.2
6/17/2012 17:08:36	44.6825	-112.5442	0.5 ML IE	116.4	3.47	6	185	15.5	0.01	5.1	7.1
6/18/2012 21:19:45	43.2653	-110.9220	1.4 ML IE	156.5	4.29	11	162	12.2	0.06	0.8	3.5
6/19/2012 13:57:37	43.1135	-111.4077	1.5 Mc IE	126.4	4.40	23	88	7.3	0.08	0.5	1.2
6/21/2012 5:24:46	42.6407	-111.6425	2.1 Mc IE	145.6	3.81	20	120	37.6	0.06	0.4	6.8
6/24/2012 9:10:58	44.6545	-114.0207	1.8 Mc IE	149.3	2.83	8	219	62.1	0.03	0.9	3.1

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
6/25/2012 11:12:12	44.6465	-114.0040	2.1 Mc MB	147.7	0.05	14	217	60.5	0.11	0.9	2.2
6/25/2012 12:44:10	43.9297	-114.3635	0.9 Mc IE	130.9	7.56	8	235	40.9	0.03	1.2	12.6
6/25/2012 16:27:11	43.2602	-111.2725	1.2 ML IE	129.7	3.20	11	163	24.3	0.09	0.8	11.9
6/27/2012 6:48:35	42.8330	-111.2662	1.8 ML IE	153.0	2.54	16	156	15.5	0.06	0.4	11.6
6/27/2012 6:49:56	42.8308	-111.2647	1.4 ML IE	153.3	7.95	8	195	15.3	0.07	1.1	5.2
6/27/2012 6:50:32	42.8237	-111.2748	1.5 ML IE	153.1	7.00	7	203	15.7	0.04	1.3	6.5
6/27/2012 22:16:41	42.7438	-111.3540	1.3 ML IE	153.8	2.10	6	263	20.9	0.03	2.4	12.7
7/1/2012 2:03:43	43.4208	-110.8797	0.4 ML IE	155.9	6.77	8	164	6.9	0.03	1.0	2.7
7/1/2012 11:10:37	44.5287	-113.8512	1.0 ML IE	129.9	5.18	6	223	43.0	0.04	1.6	9.5
7/1/2012 13:49:56	43.5783	-111.1750	0.4 Mc IE	130.0	2.75	7	256	13.7	0.07	1.3	9.8
7/1/2012 23:11:37	43.2840	-110.9160	1.0 ML IE	156.4	2.31	7	161	10.1	0.01	1.1	11.3
7/2/2012 9:25:40	44.6882	-112.5253	1.2 Mc MB	117.3	7.18	16	89	14.8	0.04	0.4	3.4
7/2/2012 14:46:40	43.3432	-111.0405	1.8 Mc IE	144.9	8.90	22	134	15.4	0.09	0.5	1.6
7/2/2012 18:09:27	43.4442	-110.9733	0.8 ML IE	148.0	3.62	9	217	5.4	0.05	1.0	1.5
7/4/2012 12:17:26	43.4092	-110.9448	1.1 ML IE	150.9	8.99	10	222	9.0	0.05	1.2	0.9
7/4/2012 18:04:28	44.5788	-114.2345	1.1 Mc IE	155.5	4.22	9	227	72.4	0.03	1.0	3.3
7/5/2012 0:21:39	42.6423	-111.4135	1.5 ML IE	158.0	2.41	23	107	29.1	0.05	0.4	12.5
7/5/2012 6:43:37	43.7742	-110.8618	1.5 ML IE	155.4	6.67	22	110	15.0	0.05	0.4	2.2
7/5/2012 9:30:11	44.3923	-114.0647	1.2 Mc IE	131.8	3.29	10	209	53.4	0.11	1.0	3.8
7/5/2012 14:30:50	44.3802	-112.7520	1.3 Mc IE	81.3	2.83	14	90	32.5	0.02	0.5	1.3
7/5/2012 22:15:34	43.0537	-111.6708	0.9 ML IE	111.9	9.64	8	268	24.0	0.07	1.9	3.0
7/7/2012 20:57:13	43.0053	-111.3570	0.5 ML IE	136.0	7.06	8	133	5.5	0.03	1.5	1.6
7/7/2012 22:50:03	44.3875	-113.0348	0.5 ML IE	84.5	15.43	5	235	9.9	0.03	1.0	1.1
7/8/2012 12:15:16	43.4547	-110.8947	0.7 ML IE	154.1	9.35	9	165	6.0	0.03	1.0	1.1
7/9/2012 15:42:53	43.2290	-111.3615	0.5 ML IE	124.2	4.94	7	201	19.5	0.02	1.3	10.0
7/10/2012 1:53:08	42.8185	-111.2020	0.6 ML IE	158.2	9.26	7	182	10.2	0.02	1.1	1.9
7/10/2012 1:53:22	42.8107	-111.1985	1.0 ML IE	159.0	9.12	5	186	9.5	0.03	1.6	2.7
7/10/2012 1:54:10	44.7320	-112.4028	1.2 Mc MB	124.2	10.86	8	244	15.4	0.02	1.9	2.1
7/10/2012 2:58:07	42.8265	-111.1978	0.3 ML IE	158.0	6.20	5	175	10.5	0.09	1.6	4.0
7/10/2012 2:58:20	42.8237	-111.1765	0.5 ML IE	159.6	11.95	5	167	9.0	0.05	1.8	2.8
7/10/2012 7:17:24	43.0180	-111.4587	0.5 ML IE	128.3	7.27	7	222	8.2	0.04	1.5	1.4
7/10/2012 20:51:44	42.7042	-111.7975	0.9 Mc IE	132.2	5.57	12	92	40.2	0.04	0.4	4.0
7/11/2012 11:18:20	43.0200	-111.4613	0.7 ML IE	128.0	5.79	11	125	8.3	0.02	0.9	1.1
7/12/2012 6:39:39	44.3630	-114.0060	1.7 Mc IE	126.1	7.21	18	204	48.3	0.06	1.1	1.4
7/12/2012 6:41:38	44.3390	-113.9945	1.2 ML IE	123.7	0.36	10	201	47.1	0.05	1.3	2.8
7/12/2012 6:44:49	43.1458	-111.3753	0.6 ML IE	127.0	2.50	7	211	10.3	0.06	1.4	10.1
7/12/2012 23:06:31	42.6775	-111.6160	1.9 Mc IE	143.9	4.50	13	172	33.0	0.02	0.7	9.5
7/12/2012 23:44:48	44.4488	-113.2992	1.3 Mc IE	98.0	1.95	6	279	17.5	0.06	12.8	3.3
7/13/2012 10:03:09	43.5090	-110.9995	0.2 Mc IE	144.8	3.31	8	209	4.5	0.04	1.5	2.9
7/14/2012 11:43:22	43.5073	-111.0097	0.6 ML IE	144.0	1.33	10	214	5.1	0.04	1.0	0.7
7/15/2012 6:43:18	44.1965	-113.1488	1.1 Mc IE	67.5	4.78	21	106	22.2	0.06	0.3	0.7
7/15/2012 21:54:12	42.7662	-111.6143	1.4 ML IE	136.7	2.81	13	178	24.7	0.03	0.6	9.3
7/16/2012 3:56:15	42.9638	-111.2122	0.3 ML IE	148.5	8.34	9	123	16.3	0.05	0.7	4.1
7/16/2012 15:35:06	43.5062	-111.0140	0.7 ML IE	143.7	1.02	11	210	5.4	0.04	1.1	0.7
7/17/2012 8:34:33	43.7385	-112.9085	0.3 ML IE	14.1	9.61	12	94	2.6	0.07	0.8	0.8
7/19/2012 8:35:20	43.3217	-111.0423	0.4 Mc IE	145.4	11.64	9	289	16.1	0.06	1.3	2.0
7/20/2012 21:42:42	43.0827	-111.3820	0.7 Mc IE	129.9	2.71	8	189	3.4	0.09	1.1	1.5
7/20/2012 23:20:37	43.7730	-110.9970	0.5 ML IE	144.5	4.88	10	153	14.5	0.02	0.8	3.4
7/20/2012 23:54:53	43.7748	-110.9962	2.1 ML IE	144.6	5.38	29	85	14.3	0.04	0.4	1.7

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
7/20/2012 23:57:42	43.7512	-110.8750	0.5 ML IE	154.1	4.79	5	209	17.0	0.07	3.1	11.7
7/20/2012 23:58:07	43.7720	-110.9940	1.7 ML IE	144.8	5.07	13	141	14.6	0.05	0.6	2.9
7/21/2012 0:00:56	43.7750	-111.0028	0.4 ML IE	144.1	5.78	7	192	14.5	0.03	0.8	4.4
7/21/2012 0:03:36	43.7728	-110.9898	0.8 ML IE	145.1	4.72	8	184	14.4	0.03	0.8	4.8
7/21/2012 0:11:19	43.7752	-111.0038	0.4 ML IE	144.0	7.08	6	193	14.5	0.02	1.3	3.2
7/21/2012 5:45:54	43.1075	-111.4280	0.6 ML IE	125.3	3.15	6	210	7.6	0.03	1.7	4.3
7/21/2012 12:57:34	44.7683	-111.8765	1.1 Mc MB	144.0	4.97	4	144	17.2	0.09	3.9	9.9
7/21/2012 13:16:17	43.3332	-111.4157	0.8 ML IE	116.0	4.97	8	210	31.3	0.07	1.5	11.8
7/21/2012 13:17:01	43.2312	-111.6472	NM	103.0	4.90	6	266	29.9	0.13	3.8	16.4
7/21/2012 14:10:27	43.2205	-111.6732	0.2 Mc IE	101.7	4.94	6	272	30.8	0.03	3.8	12.5
7/22/2012 13:22:35	43.4440	-110.9262	0.3 Mc IE	151.7	6.79	9	193	5.5	0.06	0.8	1.4
7/23/2012 14:51:28	42.7255	-111.5658	1.5 ML IE	142.7	2.51	11	188	26.4	0.06	0.7	12.1
7/24/2012 14:12:50	44.7240	-113.0290	2.3 Mc MB	121.1	5.59	19	171	18.3	0.08	0.5	0.9
7/24/2012 15:49:50	44.7182	-113.0238	1.3 Mc MB	120.4	4.33	10	171	18.4	0.05	0.7	2.0
7/24/2012 19:50:55	44.3512	-114.2942	1.0 ML IE	144.1	7.08	5	267	71.0	0.10	1.3	14.8
7/24/2012 22:12:24	44.1982	-114.0688	1.4 ML IE	119.9	4.91	16	211	54.5	0.04	0.7	3.1
7/24/2012 22:33:14	44.2047	-114.0700	2.3 Mc MB	120.3	5.23	22	213	54.4	0.04	0.6	2.5
7/25/2012 7:31:04	44.6347	-112.7170	1.1 Mc IE	109.7	10.00	8	129	23.9	0.09	0.9	2.6
7/25/2012 15:56:03	43.4488	-110.9172	0.4 ML IE	152.4	5.91	7	179	5.3	0.02	0.8	1.6
7/28/2012 21:04:05	43.4302	-113.5565	1.6 Mc IE	67.1	20.46	20	155	4.6	0.10	0.5	0.4
7/28/2012 22:20:24	44.7718	-113.0892	1.2 Mc IE	127.2	5.14	9	224	20.0	0.03	5.1	10.5
7/29/2012 8:36:02	45.0872	-112.7205	1.2 Mc MB	160.0	5.11	9	164	30.6	0.03	1.2	1.9
7/30/2012 4:32:08	42.8708	-111.5960	1.0 Mc IE	129.6	1.89	10	166	16.1	0.08	0.8	2.9
7/30/2012 13:49:40	43.4030	-111.0962	0.9 ML IE	139.0	8.46	9	270	15.2	0.04	1.3	2.9
7/30/2012 13:52:09	43.3973	-111.1047	1.2 ML IE	138.5	7.14	12	163	16.2	0.06	0.7	3.2
7/31/2012 0:57:07	44.0592	-113.2678	0.9 ML IE	59.9	5.91	12	99	20.2	0.05	0.5	1.2
7/31/2012 13:59:57	43.5593	-112.1245	1.4 Mc IE	54.1	12.87	24	127	8.8	0.12	0.7	0.4
8/1/2012 6:26:57	44.0598	-114.4658	1.4 ML IE	142.7	3.98	13	256	55.5	0.04	1.2	3.2
8/1/2012 22:48:36	44.6710	-114.0985	1.1 ML IE	154.8	1.34	10	128	68.1	0.03	0.7	2.0
8/2/2012 21:17:15	44.6022	-112.1170	1.1 Mc MB	118.6	3.00	8	152	22.0	0.05	0.7	0.6
8/4/2012 0:20:08	44.7577	-111.5732	1.3 Mc MB	156.6	11.20	10	138	7.9	0.04	0.9	0.5
8/4/2012 18:25:20	45.0125	-112.1908	2.1 Mc MB	158.8	5.81	10	165	49.3	0.06	0.5	13.5
8/4/2012 20:16:37	43.5552	-112.1340	1.0 ML IE	53.4	11.56	20	81	9.3	0.11	0.5	0.8
8/4/2012 20:17:10	43.5153	-112.1453	0.5 ML IE	53.6	12.18	7	155	9.1	0.07	1.4	1.4
8/4/2012 20:30:11	43.5428	-112.1347	0.6 Mc IE	53.7	12.37	12	171	8.7	0.11	0.9	1.2
8/5/2012 13:34:26	42.9860	-111.3882	0.4 ML IE	135.1	6.04	9	162	6.0	0.05	1.3	2.5
8/5/2012 22:03:13	44.1337	-113.0965	0.5 ML IE	59.4	4.47	12	80	15.2	0.09	0.3	1.0
8/6/2012 14:37:05	43.1490	-111.2083	0.7 ML IE	139.2	0.00	8	142	16.9	0.09	1.1	4.5
8/7/2012 4:06:04	43.3337	-111.3335	0.7 Mc IE	122.4	4.99	7	200	31.3	0.06	0.9	9.7
8/7/2012 7:25:06	43.2478	-110.9392	1.3 Mc IE	155.7	5.10	17	112	14.6	0.07	0.6	2.7
8/7/2012 15:04:43	42.6650	-111.6693	1.5 ML IE	142.1	3.50	7	216	36.5	0.06	1.1	12.7
8/8/2012 1:07:10	44.3770	-114.0582	1.9 Mc IE	130.3	6.16	18	108	52.6	0.15	0.9	2.8
8/8/2012 10:13:19	44.3628	-113.1753	0.8 Mc MB	85.3	5.84	8	133	19.0	0.03	0.7	0.9
8/10/2012 21:41:44	44.5038	-112.7540	1.3 Mc IE	95.0	6.19	9	101	24.5	0.06	0.6	12.7
8/11/2012 5:04:37	44.1258	-113.9297	0.9 Mc IE	106.2	1.20	10	195	44.1	0.06	0.6	1.7
8/11/2012 5:15:14	43.4955	-110.8480	0.0 Mc IE	157.2	2.22	8	126	8.3	0.07	0.8	13.3
8/12/2012 12:00:28	43.0335	-111.1173	1.1 ML IE	151.4	4.48	12	145	20.8	0.03	0.4	5.0
8/12/2012 14:43:57	42.6800	-111.4072	0.8 ML IE	155.4	3.27	9	289	26.9	0.04	1.9	10.7
8/12/2012 19:00:45	44.7798	-112.7997	1.6 Mc MB	125.7	13.59	10	101	6.6	0.06	0.7	0.8

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
8/12/2012 19:14:38	43.2437	-111.1098	1.1 Mc IE	142.7	8.89	8	169	24.7	0.06	0.9	3.4
8/12/2012 23:23:26	44.0723	-114.4868	2.2 Mc MB	144.7	6.85	20	195	57.0	0.07	0.6	1.9
8/13/2012 6:00:40	43.2820	-110.9285	1.2 ML IE	155.5	17.03	9	160	10.9	0.04	1.6	1.7
8/13/2012 20:18:09	42.8157	-111.3735	0.8 ML IE	147.3	2.97	7	219	14.2	0.07	1.8	8.9
8/14/2012 8:24:47	43.7532	-111.0053	0.5 Mc IE	143.7	5.39	8	156	12.9	0.03	0.8	3.0
8/14/2012 9:41:06	43.2440	-111.2850	1.5 ML IE	129.3	5.18	20	118	22.3	0.04	0.5	4.1
8/14/2012 20:32:20	44.4312	-112.9865	0.5 ML IE	88.4	6.81	6	133	11.9	0.07	1.0	0.9
8/15/2012 5:22:37	44.4552	-112.9628	0.8 ML IE	90.7	9.38	10	138	14.1	0.06	0.6	1.5
8/15/2012 14:09:27	44.4323	-113.2155	0.8 ML IE	93.7	3.81	10	164	20.3	0.05	0.4	0.8
8/16/2012 0:31:00	43.0423	-111.3630	0.4 ML IE	133.5	2.10	6	131	1.4	0.06	1.1	2.1
8/16/2012 4:26:16	43.8223	-110.9990	0.7 ML IE	144.9	2.12	9	154	9.6	0.07	1.0	13.4
8/16/2012 11:24:33	42.8370	-111.2865	1.1 ML IE	151.5	2.08	12	199	15.7	0.07	0.6	13.7
8/16/2012 23:13:04	43.7528	-111.0018	0.5 ML IE	144.0	2.97	8	154	12.9	0.02	0.7	9.9
8/18/2012 1:44:31	44.6350	-112.5920	1.8 Mc MB	110.6	13.21	11	106	16.4	0.03	0.8	1.5
8/18/2012 12:34:19	44.6295	-112.1018	1.3 Mc MB	121.8	4.17	9	140	23.6	0.06	0.6	1.1
8/20/2012 3:50:55	44.6287	-113.0837	0.8 ML IE	111.5	7.71	8	182	28.9	0.06	0.7	10.6
8/23/2012 11:21:59	44.8278	-111.7093	1.5 Mc MB	156.6	4.30	15	198	11.4	0.03	0.8	0.5
8/24/2012 14:48:06	44.6658	-112.1210	1.4 Mc MB	124.8	15.84	19	103	23.1	0.02	0.3	0.4
8/25/2012 14:54:59	44.4562	-114.3973	1.8 ML IE	157.4	0.06	11	265	80.7	0.08	1.6	2.7
8/25/2012 16:24:35	44.2685	-113.9980	0.7 Mc IE	119.3	3.42	5	241	47.5	0.06	1.1	3.3
8/26/2012 2:08:02	42.8415	-111.2185	1.6 ML IE	155.6	5.79	14	101	12.9	0.05	0.6	3.3
8/26/2012 6:50:28	42.7360	-111.4985	2.4 Mc IE	145.7	4.89	20	118	23.3	0.04	0.4	5.2
8/26/2012 13:54:50	43.2403	-111.2612	0.3 ML IE	131.3	8.43	8	175	22.6	0.05	1.1	5.8
8/26/2012 21:18:20	44.8698	-112.7273	1.5 Mc MB	135.8	11.82	8	125	10.7	0.03	0.7	1.5
8/27/2012 0:43:50	44.4032	-114.3503	1.2 Mc IE	151.0	0.83	6	289	89.1	0.03	3.7	4.1
8/28/2012 11:19:00	44.6957	-112.9943	1.0 Mc MB	117.6	0.19	6	164	18.7	0.04	1.2	2.5
8/29/2012 11:27:16	44.6993	-112.9960	1.5 Mc M	118.0	3.99	14	165	18.4	0.02	0.5	1.1
8/31/2012 2:23:08	44.7162	-113.0118	1.2 Mc M	120.0	0.11	8	203	17.9	0.06	1.0	5.4
9/1/2012 10:42:17	42.6685	-111.4943	0.7 ML IE	151.3	4.98	8	146	34.0	0.06	0.7	9.8
9/1/2012 14:04:36	43.2118	-111.4637	0.5 Mc IE	117.4	4.93	7	232	19.2	0.07	1.4	11.1
9/2/2012 21:38:41	43.3145	-111.0323	1.4 ML IE	146.4	10.99	9	136	15.6	0.02	1.0	2.8
9/2/2012 23:56:08	44.6175	-112.1183	1.3 Mc MB	120.1	14.20	10	94	22.1	0.04	0.7	1.0
9/3/2012 14:59:56	43.2463	-111.1042	0.3 ML IE	143.1	5.77	6	169	24.2	0.08	1.1	6.9
9/4/2012 2:58:32	43.1642	-110.9750	1.1 ML IE	156.0	2.28	12	163	24.2	0.07	0.7	13.8
9/4/2012 3:19:11	43.1728	-110.9695	0.3 ML IE	156.1	6.79	9	204	23.1	0.01	1.1	5.0
9/4/2012 3:38:09	43.1737	-110.9632	0.7 ML IE	156.6	3.97	7	206	22.8	0.06	1.6	10.0
9/4/2012 6:50:17	43.2570	-111.0735	0.1 Mc IE	145.0	3.82	6	171	21.5	0.08	2.6	11.3
9/4/2012 8:00:30	43.1622	-110.9690	1.0 ML IE	156.6	5.46	10	164	24.2	0.04	0.8	6.0
9/6/2012 5:13:36	43.2025	-110.9002	1.2 Mc IE	160.3	0.11	15	95	18.2	0.06	0.7	1.2
9/6/2012 5:43:39	44.2208	-113.1792	0.3 Mc IE	71.0	7.86	7	117	20.6	0.05	0.6	10.7
9/6/2012 6:26:12	43.3603	-110.9585	0.8 ML IE	151.0	7.99	7	262	8.7	0.02	1.2	2.1
9/6/2012 10:19:36	43.1990	-110.8958	0.6 ML IE	160.8	8.03	10	173	18.5	0.09	1.0	2.8
9/6/2012 22:31:33	44.3020	-112.9138	0.9 ML IE	73.3	11.11	11	163	3.7	0.07	0.6	0.7
9/7/2012 5:44:40	43.2042	-110.9017	0.8 Mc IE	160.1	2.34	13	102	18.0	0.06	0.7	12.0
9/8/2012 20:13:08	44.4253	-114.0145	1.3 ML IE	131.1	0.05	5	283	50.2	0.03	1.0	2.3
9/9/2012 19:00:39	44.0268	-114.4952	0.8 ML IE	143.9	7.93	7	257	52.1	0.07	1.4	13.6
9/10/2012 5:54:36	43.2212	-111.0083	0.8 ML IE	151.3	8.82	9	151	20.2	0.07	0.9	2.8
9/10/2012 12:42:31	44.3617	-114.0638	1.2 ML IE	129.7	4.81	13	122	52.8	0.04	0.7	2.5
9/10/2012 21:57:38	44.6363	-112.5927	1.1 Mc MB	110.8	5.32	10	149	16.5	0.04	0.9	2.0

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
9/12/2012 11:45:46	43.5117	-110.9888	0.0 Mc IE	145.7	5.87	5	202	14.4	0.04	3.6	5.2
9/12/2012 13:30:44	43.5472	-111.0173	0.8 ML IE	143.0	5.42	9	204	10.1	0.06	0.8	2.3
9/12/2012 16:27:01	43.5558	-111.0122	0.4 Mc IE	143.3	6.29	8	205	9.2	0.09	0.8	2.0
9/14/2012 11:29:51	44.4720	-114.0165	2.4 Mc MB	134.6	1.75	13	176	51.9	0.07	0.8	2.9
9/15/2012 2:05:25	42.5672	-111.5780	1.2 ML IE	155.3	5.00	8	97	44.9	0.02	0.5	10.8
9/15/2012 2:15:24	44.6895	-111.9378	1.3 Mc MB	133.9	4.48	12	112	22.0	0.06	0.5	1.2
9/15/2012 15:43:05	44.6142	-112.0763	2.8 Mc MB	121.3	15.95	11	111	25.3	0.10	0.6	0.9
9/16/2012 2:22:12	44.4420	-112.6203	0.6 Mc IE	89.1	3.81	8	80	24.6	0.07	0.4	1.1
9/16/2012 10:49:49	43.0110	-111.4137	0.6 Mc IE	131.8	4.99	6	173	37.4	0.03	0.8	12.7
9/16/2012 13:05:20	44.7442	-111.7752	1.3 Mc MB	146.0	9.54	13	142	8.8	0.03	0.6	1.0
9/17/2012 20:13:30	45.0630	-112.7170	1.2 Mc M	157.3	3.21	7	161	28.1	0.03	2.6	3.6
9/18/2012 6:15:01	44.6208	-112.1265	1.2 Mc MB	120.1	12.02	12	95	21.5	0.07	0.5	1.6
9/18/2012 9:12:35	44.7190	-112.2443	1.3 Mc MB	126.5	11.78	11	109	18.3	0.04	0.5	1.6
9/18/2012 22:16:25	44.6240	-112.0935	1.0 Mc MB	121.6	5.82	9	132	24.1	0.03	0.5	12.7
9/19/2012 8:09:04	44.3423	-111.0875	0.3 Mc IE	156.2	10.52	7	236	18.5	0.02	1.7	4.2
9/20/2012 12:30:09	44.2482	-114.1245	0.9 Mc IE	126.5	6.84	6	245	57.8	0.10	2.0	5.6
9/21/2012 20:51:55	43.2242	-111.3967	0.5 Mc IE	121.8	5.93	7	237	19.1	0.07	1.4	5.6
9/22/2012 2:29:20	43.4420	-113.6087	1.7 Mc IE	70.6	21.56	13	247	2.5	0.09	0.7	1.0
9/22/2012 2:30:17	43.4103	-113.6095	1.0 Mc IE	71.9	24.01	8	164	5.9	0.18	1.6	1.0
9/22/2012 3:37:41	42.7438	-111.7285	0.9 Mc IE	132.3	4.99	7	97	45.2	0.19	0.8	17.7
9/22/2012 8:35:50	43.9820	-113.9110	0.7 ML IE	97.9	6.98	9	186	37.3	0.18	0.9	19.7
9/24/2012 12:12:08	42.5145	-111.5678	0.6 Mc IE	160.4	2.77	7	123	67.7	0.07	0.7	4.2
9/25/2012 9:39:44	43.3953	-110.9138	0.4 ML IE	153.7	9.52	8	216	6.2	0.06	0.9	1.7
9/25/2012 15:39:04	42.6612	-111.6855	1.1 ML IE	141.6	2.93	10	138	37.6	0.02	0.6	11.8
9/26/2012 1:02:42	42.9355	-111.4918	1.0 ML IE	131.5	7.59	10	262	5.7	0.01	1.2	0.8
9/26/2012 5:21:39	42.8952	-111.2875	0.5 ML IE	147.6	5.10	6	161	11.9	0.03	1.4	7.7
9/27/2012 23:55:29	43.2362	-110.9192	0.7 ML IE	157.7	6.14	7	211	15.1	0.04	1.5	3.4
9/28/2012 0:54:49	42.6427	-111.4702	1.0 ML IE	154.8	5.01	8	115	33.0	0.07	0.6	11.7
9/28/2012 18:41:29	44.2608	-114.0490	1.1 ML IE	122.2	7.06	7	242	51.7	0.04	1.1	5.7
9/29/2012 18:07:32	44.6467	-114.1560	1.2 Mc IE	156.0	6.98	9	226	70.4	0.08	0.8	2.2
9/30/2012 12:49:00	43.4230	-111.0008	0.3 Mc IE	146.2	3.74	6	236	8.5	0.06	2.2	6.4
10/1/2012 4:41:15	43.3382	-110.9583	0.2 Mc IE	151.5	14.10	7	155	9.0	0.04	1.3	2.2
10/3/2012 18:59:24	43.3067	-111.1602	0.6 ML IE	136.7	5.01	6	164	25.8	0.06	0.8	10.6
10/4/2012 7:47:46	43.2187	-110.9288	0.8 Mc IE	157.5	2.07	6	321	17.1	0.05	2.1	13.2
10/5/2012 16:29:36	44.6575	-111.8860	1.2 Mc MB	133.1	5.94	11	100	19.2	0.04	0.6	10.0
10/5/2012 19:40:24	44.2063	-113.0222	1.2 ML IE	64.8	4.58	22	80	15.1	0.08	0.3	0.8
10/7/2012 16:12:39	44.6148	-112.5640	1.2 Mc MB	108.8	4.88	12	122	13.7	0.03	0.6	1.2
10/8/2012 2:34:34	43.5255	-112.7085	0.5 ML IE	15.1	2.40	10	205	12.5	0.10	0.6	0.4
10/8/2012 3:37:10	43.3315	-111.0425	0.5 ML IE	145.1	13.36	9	144	15.8	0.07	0.9	2.2
10/8/2012 10:32:35	42.5772	-111.5867	1.0 ML IE	154.0	5.00	9	136	42.3	0.10	0.6	13.3
10/8/2012 10:38:20	42.5860	-111.5993	1.3 ML IE	152.6	2.50	12	93	41.7	0.06	0.5	13.4
10/9/2012 10:22:35	43.7392	-111.0442	0.8 Mc IE	140.5	2.32	12	176	11.3	0.06	0.8	9.9
10/9/2012 10:23:56	43.7378	-111.0572	0.7 ML IE	139.4	2.18	12	182	11.3	0.07	1.5	12.1
10/9/2012 10:25:16	43.7390	-111.0453	0.5 Mc IE	140.4	2.02	8	213	11.3	0.07	1.2	13.9
10/9/2012 13:59:46	43.7368	-111.0423	0.4 Mc IE	140.6	2.45	9	175	11.0	0.05	0.9	9.5
10/10/2012 9:56:12	42.7490	-111.2393	1.5 ML IE	160.5	10.02	17	133	11.5	0.03	0.5	0.7
10/10/2012 14:07:43	44.7047	-111.8668	1.0 Mc MB	138.3	5.94	8	159	16.2	0.03	0.7	11.0
10/11/2012 2:27:36	44.7443	-111.8682	1.0 Mc MB	142.0	11.75	6	206	16.1	0.07	1.8	2.7
10/11/2012 5:48:31	44.6322	-112.1168	1.1 Mc M	121.6	5.70	14	96	22.4	0.02	0.4	3.4

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
10/11/2012 8:48:30	43.2438	-110.9325	1.0 ML IE	156.4	2.01	14	111	14.7	0.07	0.7	13.7
10/11/2012 11:12:51	43.8983	-113.9578	0.2 Mc IE	98.5	7.54	7	220	40.8	0.07	1.4	13.2
10/11/2012 11:13:19	43.3098	-110.8740	0.2 Mc IE	158.9	0.03	7	310	6.1	0.06	1.3	0.9
10/12/2012 5:52:56	44.6948	-111.9252	1.1 Mc MB	135.0	5.25	12	114	20.9	0.05	0.4	1.1
10/12/2012 9:13:45	44.7233	-113.6992	2.4 Mc MB	140.1	7.83	9	243	51.5	0.08	2.0	1.7
10/13/2012 0:45:01	42.8530	-111.3078	0.4 ML IE	149.0	12.21	5	197	13.2	0.02	1.1	2.2
10/13/2012 15:21:49	44.9905	-112.2583	2.4 Mc MB	154.9	6.48	13	153	45.4	0.03	0.5	12.1
10/14/2012 11:36:55	43.3103	-110.8795	0.5 ML IE	158.5	5.23	10	309	6.2	0.07	1.1	1.1
10/17/2012 14:31:48	43.5105	-111.0145	0.6 ML IE	143.6	1.06	9	215	5.6	0.06	0.7	0.8
10/18/2012 4:43:48	43.3043	-111.1325	1.4 ML IE	138.9	7.03	12	181	23.7	0.04	0.8	5.0
10/18/2012 10:45:53	43.0333	-111.3183	0.6 ML IE	137.1	4.91	10	104	4.8	0.04	0.7	1.7
10/18/2012 10:48:18	43.0432	-111.3277	0.6 ML IE	135.9	6.08	11	101	3.7	0.07	0.6	1.1
10/19/2012 7:19:43	43.5177	-111.0052	0.2 Mc IE	144.3	0.31	7	209	5.4	0.07	2.0	0.9
10/19/2012 20:29:03	43.3043	-111.1048	1.0 ML IE	141.1	7.79	9	285	21.5	0.02	1.1	4.6
10/21/2012 11:15:42	43.3620	-110.9817	0.2 ML IE	149.1	8.39	7	265	10.5	0.03	1.6	2.9
10/22/2012 5:59:43	44.7132	-112.4600	1.4 Mc MB	121.1	1.63	7	96	14.3	0.08	0.6	1.4
10/22/2012 11:08:24	42.9608	-111.2912	1.3 ML IE	143.2	5.27	15	113	10.9	0.05	0.4	2.2
10/22/2012 11:11:55	42.9618	-111.2848	1.3 ML IE	143.6	4.58	12	112	11.5	0.03	0.4	3.3
10/22/2012 11:21:38	42.9632	-111.3062	0.7 ML IE	142.1	7.99	9	112	9.8	0.08	0.8	2.6
10/22/2012 11:28:32	42.9642	-111.3000	0.5 Mc IE	142.4	8.71	7	111	10.3	0.08	1.1	3.8
10/22/2012 11:33:22	42.9615	-111.3038	1.0 ML IE	142.3	9.10	8	113	10.0	0.05	1.0	3.2
10/22/2012 14:38:42	44.2685	-111.1295	0.4 ML IE	149.4	2.91	6	225	9.7	0.03	1.2	6.7
10/23/2012 3:27:20	42.9605	-111.3105	0.5 ML IE	141.9	10.58	9	114	9.4	0.07	0.8	2.3
10/23/2012 3:40:22	42.8693	-111.2760	1.0 ML IE	150.0	3.25	9	175	14.1	0.05	0.9	11.5
10/23/2012 11:48:01	42.9053	-111.2083	0.7 ML IE	152.3	12.15	8	132	17.8	0.04	0.7	2.6
10/24/2012 1:31:34	44.5097	-112.8735	1.3 Mc MB	95.9	5.01	4	120	35.4	0.07	0.8	13.6
10/25/2012 12:24:23	44.7718	-113.7700	1.6 Mc MB	147.6	0.60	7	243	58.9	0.05	2.9	3.5
10/25/2012 18:43:52	44.3222	-111.1100	0.3 ML IE	153.6	4.02	5	237	15.8	0.02	2.2	9.9
10/26/2012 0:19:34	44.6192	-112.0772	1.3 Mc MB	121.7	4.55	10	95	25.3	0.06	0.6	1.2
10/26/2012 11:41:53	44.8280	-113.8987	1.1 ML IE	158.5	0.31	11	138	69.6	0.18	1.5	8.5
10/27/2012 15:33:48	44.3902	-112.8123	1.1 Mc IE	82.4	9.18	12	164	12.3	0.04	0.7	1.3
10/27/2012 22:38:00	42.9655	-111.1888	0.4 ML IE	150.0	9.28	8	128	17.7	0.08	0.6	4.5
10/28/2012 9:23:03	43.7268	-111.0410	0.6 ML IE	140.6	2.27	9	175	9.9	0.07	0.8	11.9
10/28/2012 13:03:48	43.7365	-111.0375	0.4 Mc IE	141.0	2.03	8	208	11.0	0.10	0.9	14.9
10/28/2012 14:02:01	44.8150	-113.8477	2.2 Mc MB	155.0	0.88	11	136	66.1	0.07	1.5	2.8
10/28/2012 14:24:31	44.8088	-113.8638	1.7 Mc MB	155.1	0.54	10	135	66.3	0.06	1.4	2.8
10/29/2012 6:38:44	43.6760	-111.0532	0.6 ML IE	139.5	2.09	10	192	4.7	0.08	0.9	10.1
10/29/2012 10:49:07	42.8652	-111.1937	0.8 ML IE	155.8	5.06	10	149	13.5	0.04	0.7	5.8
10/29/2012 16:47:27	42.8608	-111.1940	2.3 ML IE	156.0	11.07	17	115	13.1	0.04	0.3	0.9
10/30/2012 14:36:48	44.0180	-114.4357	1.4 Mc IE	139.0	7.25	9	251	50.7	0.03	1.0	12.7
10/31/2012 14:23:46	42.9077	-111.5457	0.8 ML IE	130.0	7.42	8	154	10.7	0.06	0.6	1.4
10/31/2012 17:49:51	44.9877	-112.2363	1.7 Mc MB	155.1	8.37	9	156	45.6	0.03	0.5	10.8
11/1/2012 2:50:24	43.5830	-111.2005	0.8 Mc IE	127.9	4.29	7	261	15.3	0.02	1.7	5.1
11/3/2012 8:57:14	44.3590	-114.0352	2.0 Mc MB	127.7	5.01	15	206	50.5	0.10	1.4	13.8
11/4/2012 18:46:57	42.6212	-111.4312	1.2 ML IE	158.7	8.00	12	108	31.5	0.10	0.5	4.2
11/5/2012 1:15:32	44.4508	-112.7830	1.3 Mc MB	89.1	8.96	11	105	18.5	0.04	0.5	2.6
11/5/2012 1:16:23	44.4520	-112.7835	1.4 Mc MB	89.2	7.08	13	105	18.5	0.10	0.6	8.8
11/5/2012 1:18:08	44.4470	-112.7837	1.2 Mc MB	88.7	11.19	6	105	18.1	0.05	0.7	3.1
11/5/2012 1:38:34	44.4457	-112.7833	1.8 Mc IE	88.5	13.10	6	106	18.0	0.05	0.8	2.7

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
11/5/2012 3:44:50	44.4442	-112.7905	1.2 Mc MB	88.4	6.91	6	161	17.5	0.05	1.0	13.1
11/5/2012 5:32:42	44.4452	-112.7808	1.2 Mc MB	88.5	12.41	6	106	18.1	0.05	0.7	2.8
11/5/2012 6:22:45	44.4442	-112.7820	1.2 Mc MB	88.4	12.69	6	106	18.0	0.03	0.7	2.7
11/5/2012 7:44:19	44.4460	-112.7813	1.4 Mc MB	88.6	12.69	6	106	18.2	0.04	0.7	2.8
11/5/2012 8:10:55	44.4327	-112.7823	0.7 ML IE	87.1	10.99	6	108	17.1	0.05	0.7	2.9
11/5/2012 8:49:01	44.4378	-112.7782	1.2 Mc MB	87.6	11.12	6	108	17.7	0.04	0.7	3.0
11/5/2012 13:58:29	43.7387	-111.0423	0.4 Mc IE	140.6	2.26	7	212	11.2	0.06	0.9	12.0
11/5/2012 14:03:06	43.7383	-111.0495	0.6 Mc IE	140.0	2.31	8	216	11.3	0.06	1.0	10.9
11/5/2012 14:18:07	43.7387	-111.0455	0.6 Mc IE	140.4	2.15	9	176	11.3	0.06	0.9	12.8
11/5/2012 19:20:30	43.7392	-111.0488	0.5 ML IE	140.1	2.15	9	178	11.4	0.06	0.8	12.8
11/5/2012 21:50:45	43.1592	-110.9155	0.7 Mc IE	160.8	3.02	10	174	23.2	0.05	1.2	11.6
11/5/2012 23:33:16	43.4288	-111.1057	0.7 ML IE	137.7	10.33	6	266	14.3	0.03	2.0	2.7
11/6/2012 0:18:57	43.1605	-110.9187	0.9 ML IE	160.5	3.55	11	173	23.1	0.03	0.8	9.3
11/6/2012 4:12:04	43.7375	-111.0373	0.8 Mc IE	141.0	2.00	10	172	11.1	0.13	1.1	16.3
11/6/2012 5:12:24	42.6602	-111.6517	0.8 ML IE	143.5	5.00	8	116	46.7	0.02	0.6	10.9
11/6/2012 9:06:10	43.7398	-111.0485	0.2 ML IE	140.1	2.32	9	215	11.4	0.06	0.9	11.0
11/6/2012 10:11:17	43.7348	-111.0365	0.7 Mc IE	141.1	2.17	8	172	10.8	0.06	1.0	12.9
11/6/2012 10:16:25	43.7385	-111.0492	0.4 Mc IE	140.1	2.43	7	216	11.3	0.03	1.2	10.7
11/6/2012 10:59:02	43.2507	-110.9158	0.3 Mc IE	157.5	4.18	7	317	13.5	0.04	2.0	5.0
11/6/2012 18:58:37	43.7320	-111.0385	1.2 ML IE	140.9	2.32	11	174	10.5	0.07	0.7	10.0
11/6/2012 21:18:25	42.7445	-111.6212	1.1 Mc IE	138.0	2.51	8	299	27.0	0.09	1.7	13.5
11/6/2012 23:09:38	42.9117	-111.4905	0.5 ML IE	133.2	2.84	6	275	6.3	0.05	2.2	4.5
11/7/2012 5:39:55	43.7365	-111.0408	0.2 ML IE	140.7	2.48	8	174	11.0	0.08	0.8	11.1
11/7/2012 7:02:14	43.7335	-111.0365	0.6 ML IE	141.0	2.14	10	173	10.6	0.06	0.8	12.5
11/7/2012 7:14:55	43.7322	-111.0405	0.9 Mc IE	140.7	2.11	9	175	10.5	0.09	0.9	14.4
11/7/2012 8:08:00	43.7340	-111.0472	1.0 ML IE	140.2	2.19	10	177	10.8	0.09	1.0	13.1
11/7/2012 9:32:23	43.7340	-111.0547	0.8 ML IE	139.6	2.07	10	181	10.9	0.10	1.3	14.9
11/7/2012 11:21:01	42.9082	-111.4850	1.6 Mc IE	133.8	2.09	14	172	6.1	0.06	0.9	11.4
11/7/2012 13:00:28	43.7365	-111.0443	0.9 ML IE	140.4	2.22	10	176	11.0	0.07	1.0	12.1
11/7/2012 13:46:20	43.7338	-111.0407	0.8 ML IE	140.7	2.21	10	174	10.7	0.10	0.9	13.6
11/7/2012 20:31:26	44.5267	-114.3087	1.5 ML IE	156.3	3.15	8	137	75.8	0.09	0.9	3.4
11/7/2012 21:15:26	43.7385	-111.0538	1.0 ML IE	139.7	2.35	8	219	11.4	0.05	1.0	10.9
11/7/2012 22:35:04	43.8588	-113.4442	1.1 ML IE	58.1	4.64	14	108	7.8	0.06	0.4	0.7
11/8/2012 4:42:38	43.7313	-111.0263	0.3 Mc IE	141.9	2.02	9	166	10.3	0.08	0.7	14.0
11/8/2012 10:19:10	44.6987	-111.9280	1.6 Mc MB	135.2	4.43	7	115	21.1	0.07	0.8	2.3
11/8/2012 17:13:09	44.4177	-114.0940	1.9 Mc IE	135.4	0.41	12	266	56.2	0.04	2.0	10.7
11/8/2012 23:36:14	42.7508	-111.8270	1.3 ML IE	126.6	15.06	10	89	46.4	0.01	0.4	0.7
11/9/2012 5:29:43	43.7272	-111.0863	0.2 Mc IE	137.0	2.51	5	195	11.0	0.07	2.7	11.7
11/9/2012 7:35:19	43.7357	-111.0320	0.4 Mc IE	141.4	2.00	9	170	10.8	0.07	0.7	13.8
11/9/2012 9:58:07	43.7367	-111.0430	0.6 ML IE	140.5	2.23	9	175	11.0	0.08	0.8	12.6
11/9/2012 11:25:59	43.7333	-111.0372	0.5 Mc IE	141.0	2.15	8	173	10.6	0.05	0.8	12.8
11/9/2012 17:32:13	43.7385	-111.0317	1.3 ML IE	141.5	2.43	11	170	11.1	0.10	0.7	10.6
11/9/2012 17:38:40	43.7360	-111.0075	0.2 ML IE	143.4	2.18	7	156	11.0	0.04	1.3	12.7
11/10/2012 16:06:03	43.9037	-113.7212	1.3 Mc IE	80.6	2.47	15	197	21.8	0.09	0.8	1.2
11/10/2012 19:00:20	44.4985	-114.2157	2.4 Mc IE	148.6	0.64	12	256	67.8	0.10	1.5	3.4
11/11/2012 15:59:11	44.5205	-114.3115	2.0 Mc MB	156.0	1.28	14	118	75.9	0.09	0.7	1.9
11/11/2012 16:35:18	44.4798	-114.2782	0.9 Mc IE	151.2	5.67	7	258	90.1	0.07	1.3	3.7
11/12/2012 5:13:37	42.7550	-111.2747	1.4 ML IE	157.9	4.42	15	92	14.3	0.05	0.4	4.4
11/12/2012 9:08:25	43.3490	-110.8792	0.6 ML IE	157.5	2.29	10	175	2.7	0.04	0.7	1.8

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
11/13/2012 17:58:15	44.5732	-113.9932	1.0 ML IE	141.2	6.45	6	284	55.1	0.06	1.9	5.5
11/13/2012 21:10:14	44.4213	-113.0278	0.9 ML IE	88.0	10.15	11	129	12.3	0.06	0.4	1.5
11/14/2012 22:33:15	43.5038	-111.1217	0.8 ML IE	135.1	10.00	10	232	13.9	0.07	1.1	1.7
11/15/2012 16:23:00	44.6928	-112.4783	2.5 Mc MB	118.5	9.76	35	92	12.9	0.04	0.2	0.6
11/15/2012 17:21:37	44.7233	-112.4655	0.9 Mc MB	122.1	0.02	6	113	15.5	0.03	1.0	2.6
11/16/2012 7:01:39	43.8913	-110.9785	1.1 ML IE	147.7	6.93	11	146	3.2	0.05	0.5	0.7
11/17/2012 19:39:45	44.3643	-111.0535	0.6 Mc IE	159.8	3.47	5	235	21.9	0.05	2.1	11.0
11/17/2012 20:55:48	43.2528	-110.9442	1.2 ML IE	155.2	0.03	11	160	14.3	0.09	0.9	2.0
11/17/2012 22:03:55	42.7042	-111.5720	1.2 Mc IE	144.1	3.07	12	95	28.7	0.13	0.5	12.3
11/19/2012 12:46:12	44.7077	-112.4107	1.3 Mc MB	121.4	2.87	9	180	12.8	0.06	0.8	0.7
11/19/2012 22:52:49	44.2455	-114.1160	2.4 Mc M	125.8	3.33	22	218	57.2	0.04	0.5	2.3
11/20/2012 20:41:04	42.9033	-111.4652	1.5 ML IE	135.4	6.17	12	170	5.2	0.04	1.1	0.7
11/20/2012 20:41:28	42.8907	-111.5188	1.8 ML IE	132.9	7.25	8	274	9.5	0.04	1.4	1.1
11/20/2012 21:08:18	42.8935	-111.5348	2.0 ML IE	131.7	6.16	9	275	10.5	0.05	1.4	1.3
11/21/2012 0:58:27	42.8755	-111.5698	1.2 ML IE	130.8	4.46	7	292	14.0	0.05	1.6	4.3
11/21/2012 15:48:49	44.7967	-111.7640	1.3 ML IE	151.3	10.69	7	220	10.8	0.01	1.8	1.7
11/22/2012 0:19:59	42.8167	-111.2872	0.8 ML IE	152.8	9.30	5	211	16.3	0.02	2.0	4.6
11/23/2012 0:14:21	44.8557	-112.1593	1.5 Mc MB	143.1	0.93	12	140	34.6	0.05	0.6	1.6
11/23/2012 3:48:16	42.5830	-111.5878	0.7 ML IE	153.4	5.74	8	235	41.7	0.10	1.4	7.7
11/23/2012 4:12:03	43.3763	-110.9428	0.9 ML IE	151.8	5.49	11	122	7.5	0.07	0.8	2.5
11/23/2012 6:38:25	42.8717	-111.1310	0.7 ML IE	159.6	9.63	9	140	12.1	0.02	1.0	3.8
11/23/2012 17:12:42	43.5100	-111.0127	0.8 ML IE	143.8	0.88	9	209	5.5	0.05	0.9	0.6
11/23/2012 20:15:13	43.5060	-111.0118	0.7 Mc IE	143.9	2.68	9	216	5.3	0.06	0.9	3.9
11/24/2012 4:19:37	44.5822	-112.8503	0.4 ML IE	103.9	2.26	4	165	27.3	0.00	2.8	3.3
11/24/2012 15:37:56	43.5072	-111.0125	2.1 ML IE	143.8	1.56	34	139	5.3	0.04	0.3	0.4
11/25/2012 3:02:43	43.1720	-110.9322	0.6 ML IE	159.0	10.64	8	222	22.1	0.11	1.5	3.2
11/25/2012 3:19:12	43.1660	-110.9247	0.5 ML IE	159.8	3.51	8	225	22.6	0.04	1.3	9.5
11/25/2012 7:02:25	43.5107	-111.0120	0.5 ML IE	143.8	1.03	8	209	5.5	0.04	1.0	0.7
11/25/2012 17:17:36	43.5057	-111.0173	0.6 ML IE	143.5	2.53	9	212	5.7	0.07	0.9	5.1
11/25/2012 17:44:54	43.3133	-110.9050	1.1 ML IE	156.4	5.45	10	157	6.9	0.07	0.6	1.4
11/26/2012 10:33:49	43.5057	-111.0183	0.8 Mc IE	143.4	1.24	9	212	5.7	0.04	0.8	0.7
11/27/2012 1:52:39	42.9238	-111.4620	0.9 Mc IE	134.2	0.01	6	267	3.7	0.13	2.1	0.9
11/27/2012 15:26:50	44.0080	-114.4372	1.9 ML IE	138.8	6.92	7	250	49.6	0.03	1.1	12.8
11/27/2012 20:13:44	43.5183	-110.9747	0.0 ML IE	146.7	3.02	5	193	3.7	0.05	1.1	2.5
11/29/2012 8:15:38	44.4458	-113.9457	1.1 ML IE	128.5	6.99	7	222	45.6	0.07	1.0	4.4
11/29/2012 9:22:00	43.5110	-111.0037	0.8 Mc IE	144.5	1.59	9	210	4.9	0.06	1.3	0.9
11/30/2012 5:03:52	43.3398	-110.9555	0.9 ML IE	151.7	5.09	8	278	8.8	0.07	1.4	3.1
11/30/2012 8:18:18	43.5153	-111.0018	0.6 Mc IE	144.6	1.19	9	208	5.0	0.05	0.9	0.7
12/1/2012 21:32:43	43.8470	-113.4525	0.9 ML IE	58.2	3.55	9	112	9.1	0.05	0.5	0.8
12/2/2012 12:41:35	43.3377	-110.9350	1.0 ML IE	153.4	2.28	7	281	7.3	0.09	1.5	11.1
12/3/2012 18:35:47	44.6157	-114.0477	1.3 Mc IE	147.6	5.03	5	241	61.3	0.07	2.3	11.8
12/4/2012 5:17:00	43.2598	-111.4453	1.1 Mc IE	116.6	3.92	9	206	23.7	0.07	1.1	9.8
12/5/2012 18:10:16	44.3395	-114.0318	1.5 ML IE	126.1	6.34	12	219	50.1	0.10	1.0	4.2
12/7/2012 8:03:50	43.2078	-110.9038	0.9 ML IE	159.8	0.03	7	218	17.7	0.07	1.8	2.5
12/11/2012 8:22:48	44.1930	-114.5097	1.5 ML IE	151.2	7.14	7	268	70.5	0.06	1.3	6.6
12/12/2012 6:45:15	44.7177	-111.7960	1.7 Mc MB	142.6	5.07	12	180	76.3	0.05	0.5	2.6
12/13/2012 2:31:02	43.9560	-114.2582	1.4 Mc IE	123.4	2.06	10	284	64.8	0.07	1.7	4.1
12/15/2012 15:23:53	43.1292	-110.9445	0.5 ML IE	159.8	5.80	11	171	27.0	0.03	0.7	5.4
12/17/2012 13:51:52	43.8260	-110.9838	0.5 ML IE	146.2	2.50	7	149	21.2	0.05	0.7	12.3

ORIGIN TIME	LAT N	LONG W	MAG-TYPE	DIST	Z	NO	GAP	DMIN	RMS	ERH	ERZ
12/17/2012 22:21:01	44.2510	-114.0993	2.1 Mc MB	125.0	0.85	19	218	55.8	0.06	0.6	1.4
12/18/2012 22:23:01	43.7080	-111.0623	1.0 Mc IE	138.8	2.32	8	191	8.3	0.05	0.8	11.0
12/22/2012 7:24:53	43.7388	-111.0822	0.4 Mc IE	137.4	2.45	8	235	12.0	0.10	2.8	10.8
12/24/2012 10:13:31	44.7433	-111.7835	1.5 Mc MB	145.5	3.53	8	141	9.5	0.02	0.8	1.4
12/24/2012 23:39:12	43.2138	-110.8997	0.6 ML IE	160.0	5.68	7	171	16.9	0.09	1.4	4.5
12/26/2012 5:53:07	44.6033	-112.7468	1.2 Mc MB	106.1	2.56	11	104	26.2	0.04	0.4	1.0
12/26/2012 7:20:47	44.6973	-112.5365	1.8 Mc MB	118.2	13.95	10	89	16.2	0.06	0.5	1.3
12/29/2012 6:19:15	43.7998	-110.8310	1.4 ML IE	158.1	6.70	11	120	23.9	0.02	0.5	4.1
12/30/2012 19:12:53	43.4585	-110.9030	0.1 Mc IE	153.3	8.61	7	155	5.2	0.04	0.6	1.8
12/31/2012 21:52:05	43.2540	-111.3548	0.8 ML IE	123.7	4.96	8	209	42.0	0.04	0.9	11.9