The Pennsylvania State University

The Graduate School

College of Earth and Mineral Science

SEISMICITY IN PENNSYLVANIA

A Thesis in

Geosciences

By

Kyle A. Homman

Submitted in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science

December 2015

The thesis of Kyle A. Homman was reviewed and approved* by the following:

Andrew A. Nyblade

Professor of Geoscience

Thesis Adviser

Charles J. Ammon

Professor of Geoscience

Sridhar X. Anandakrishnan

Professor of Geoscience

Michael A. Arthur

Professor and Interim Associate Head for Graduate Programs and Research

*Signatures are on file in the Graduate School.

Abstract

In this thesis, data from several seismic networks have been used to develop a catalog of seismic events in Pennsylvania from February 2013 to December 2014. Using the Antelope Environmental Data Collection Software Suite, P-wave arrivals were picked using 1-5 Hz bandpass filtered vertical component seismograms. Initial hypocenters were determined using the IASP91 velocity model. P-wave arrival times were subsequently used with the HYPOELLIPSE code (Lahr, 1989; Lahr, 1999) and a velocity model developed for Pennsylvania to relocate the events. The catalog consists of 1355 events in Pennsylvania and is complete to a M_L of 2.0. Magnitudes were computed using Richter's (1935) method for determining local magnitude (M_L). Most events occurred between 12:00 and 22:00 UTC during week days. The Gutenberg-Richter plot yielded a b-value of 2.63 for the catalog.

Events were classified based on criteria used by the United States Geological Survey and others for determining mining-related seismicity. The results of event classification showed that the catalog predominantly consists of mining-related seismicity. Through the classification process, 11 of the 1355 events in the catalog were found to be unrelated to mining activity. P-wave and S-wave arrival times for these events were repicked using 1-10 Hz bandpass filtered data and relocated using the Pennsylvania velocity model and HYPOELLIPSE. Event locations and origin times were examined to determine if there was a spatial and temporal correlation with natural gas extraction activity. No correlation was found and therefore there appears to be little, if any, evidence for seismic events in the catalog caused by

hydraulic fracturing or wastewater injection. The 11 non-mining related events all occurred in areas of known faults.

A cross correlation match and locate technique was applied to a cluster of events near Williamsport, PA using a template event that occurred on September 25, 2013. Upon locating the cross correlation detections relative to the template event, and then moving the locations to the centroid of the cluster, it was determined that the cluster is a result of mining-activity at the Thomas Coal Mine.

The findings of this study are important for future monitoring of seismicity in Pennsylvania. The natural gas production region and the bituminous coal region in the Commonwealth overlap spatially. Accurate event locations, magnitude estimates, and origin times are required to discriminate between mining events and possible seismicity induced by natural gas production. To obtain that information, a large, permanent seismic network is required. The amount of mining-related seismicity generated from both coal and industrial mineral mines also creates challenges for detecting and locating small tectonic events in both known and possibly unknown areas of earthquake activity.

Table of Contents

List of Figures

List of Tables

Acknowledgements

This work was made possible by the support of my faculty mentors, including Andy Nyblade, family members and friends. For this I owe them a huge thank you. I also thank Sharmin Shamsalsadati, Marsella Kachingwe, and Ashley Grijalva for helping pick and locate seismic events, and Chengping Chai for use of his cross correlation location code. Financial support for my research has been provided by the Earth and Environmental Systems Institute at Penn State.

Chapter 1

Building the Catalog of Seismic Events

Introduction

In this thesis, seismic data recorded by networks of seismometers within and surrounding Pennsylvania from February 2013 to December 2014 have been used to investigate seismic activity within Pennsylvania. The seismic data were used to construct a catalog of events, and then the location, origin times, and waveform characteristics of the events were used to investigate the nature of the seismicity and identify its causes.

Background

Seismicity in the eastern United States and Pennsylvania in particular, is less frequent than in the western U.S. Nevertheless, earthquakes occur in many areas of the eastern U.S. (Figure 1.1), and even though many events are small, the capability for large, damaging events exists. This is illustrated by several historic earthquakes, such as the September 1st, 1886 magnitude 7.3 Charleston, South Carolina earthquake, the May 31, 1897 magnitude 5.9 Giles County, Virginia earthquakes (Bollinger and Wheeler, 1983) and the August 23, 2011 magnitude 5.8 Mineral,

Virginia earthquake (USGS, 2011). The September 5, 1944 magnitude 5.8 Massena, New York (Bent A.L, 1996) and the September 25, 1998 magnitude 5.2 Pymatuning, Pennsylvania earthquakes (Maceira et al., 2000) are the largest earthquakes to have occurred within and near to Pennsylvania. All of these events, coupled with the fact that seismic attenuation is lower in the eastern United States than in the west, highlight the potential for damaging earthquakes in the eastern U.S. (Nikolau et al., 2012; Kim, 1998).

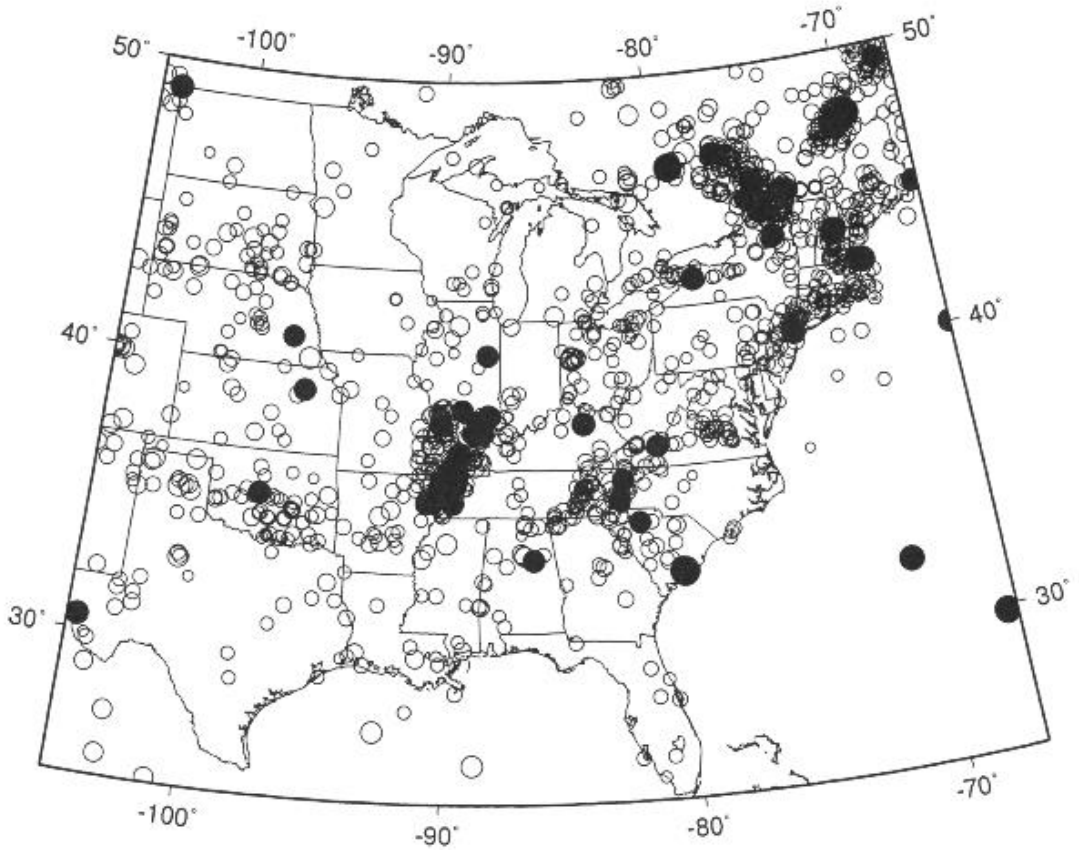
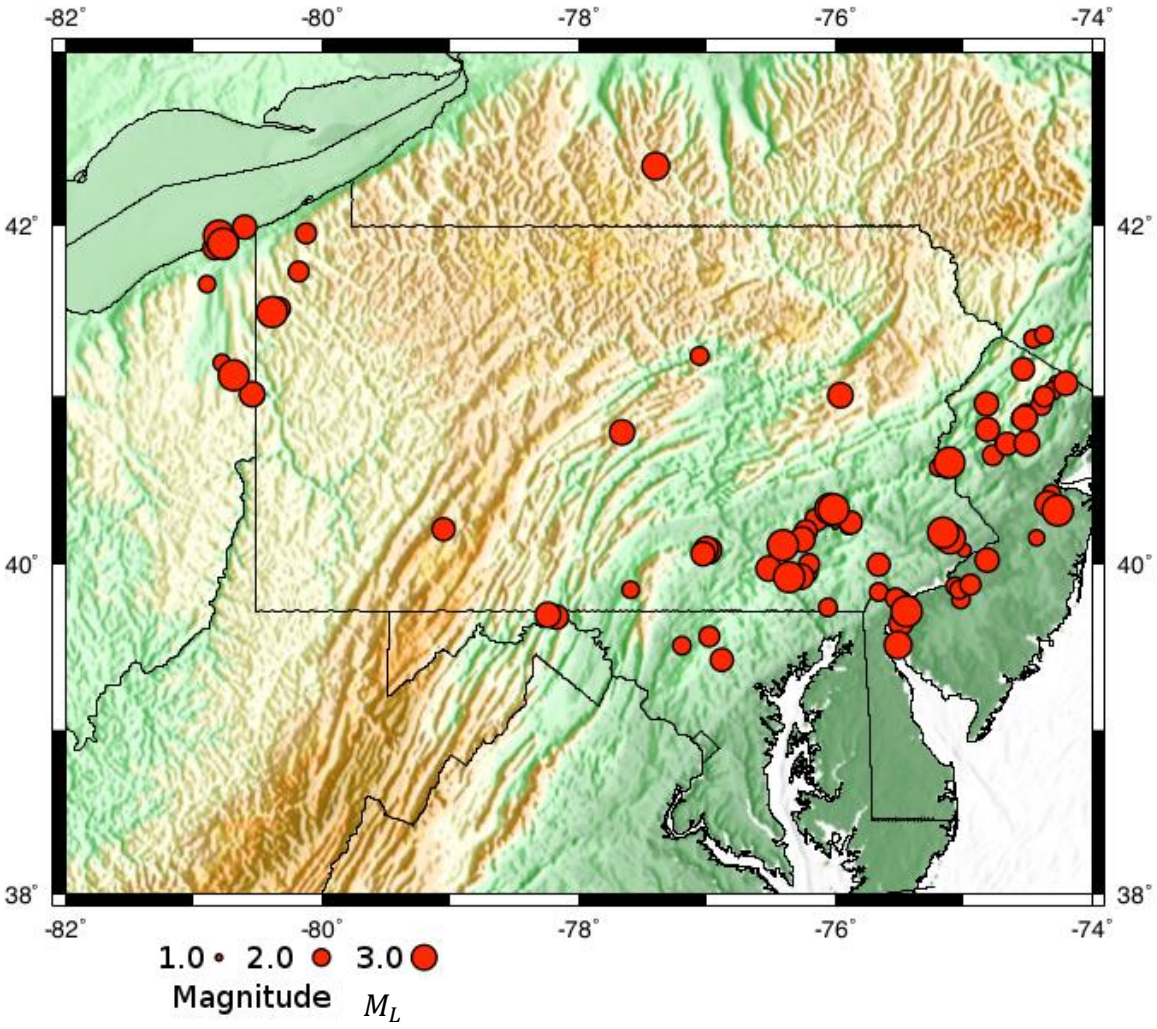


Figure 1.1: Historical earthquakes in the central and eastern U.S. from 1924 to 1991 (Frankel, 1995).

Seismicity in the eastern U.S. has been investigated by a number of authors over the past several decades (e.g., Armbruster and Seeber, 1987; Bollinger and Wheeler, 1983; Chinnery and Rogers, 1973; Chinnery, 1979; Long and Mareschal, 1989; Yang and Aggarwal, 1981), but little attention has been given to seismic activity within Pennsylvania. This is partially because of sparse station coverage, which has limited the completeness of the United States Geological Survey (USGS) catalog to about magnitude 3 for events in Pennsylvania.

Earthquakes in Pennsylvania occur primarily in the southeastern portion of the state (Figure 1.2). However, earthquakes have also occurred sporadically across

the state. While the majority of the events are small, there have been moderate size events in the past, such as the Pymatuning earthquake. In southeastern Pennsylvania, the majority of events have occurred in the Lancaster Seismic Zone (LSZ) (Armbruster and Seeber, 1987). The LSZ is in Lancaster County at the western edge of the Newark Basin Seismic Zone (NBSZ), which is a broader seismic zone that extends from the LSZ through New Jersey and into New York (Armbruster and Seeber, 1987). Figures 1.3 and 1.4 show the locations of the NBSZ and the LSZ. The NBSZ borders the Newark Basin, which formed by Mesozoic rifting (Ratcliff et al, 1971; Armbruster and Seeber, 1987), and there has been little seismic activity in the basin itself. The western side of the NBSZ is marked by the Ramapo fault system, which is characterized by a northeast strike and a southeast dip and extends from southeastern New York through eastern Pennsylvania and continues south of Harrisburg (Armbruster and Seeber, 1987) (Figure 1.5). Several felt earthquakes have occurred in the area of the LSZ and NBSZ, such as the April 23, 1984 magnitude ($M_{b_{Lg}}$) 4.1 Marticville (Armbruster and Seeber, 1987) and the January 16, 1994 magnitude ($M_{b_{Lg}}$) 4.6 Cacoosing Valley earthquakes (Seeber et al., 1998).


-82°
-80°
-78°
-76°
-74°
42°
40°
38°
1.0
2.0
3.0
Magnitude M_L

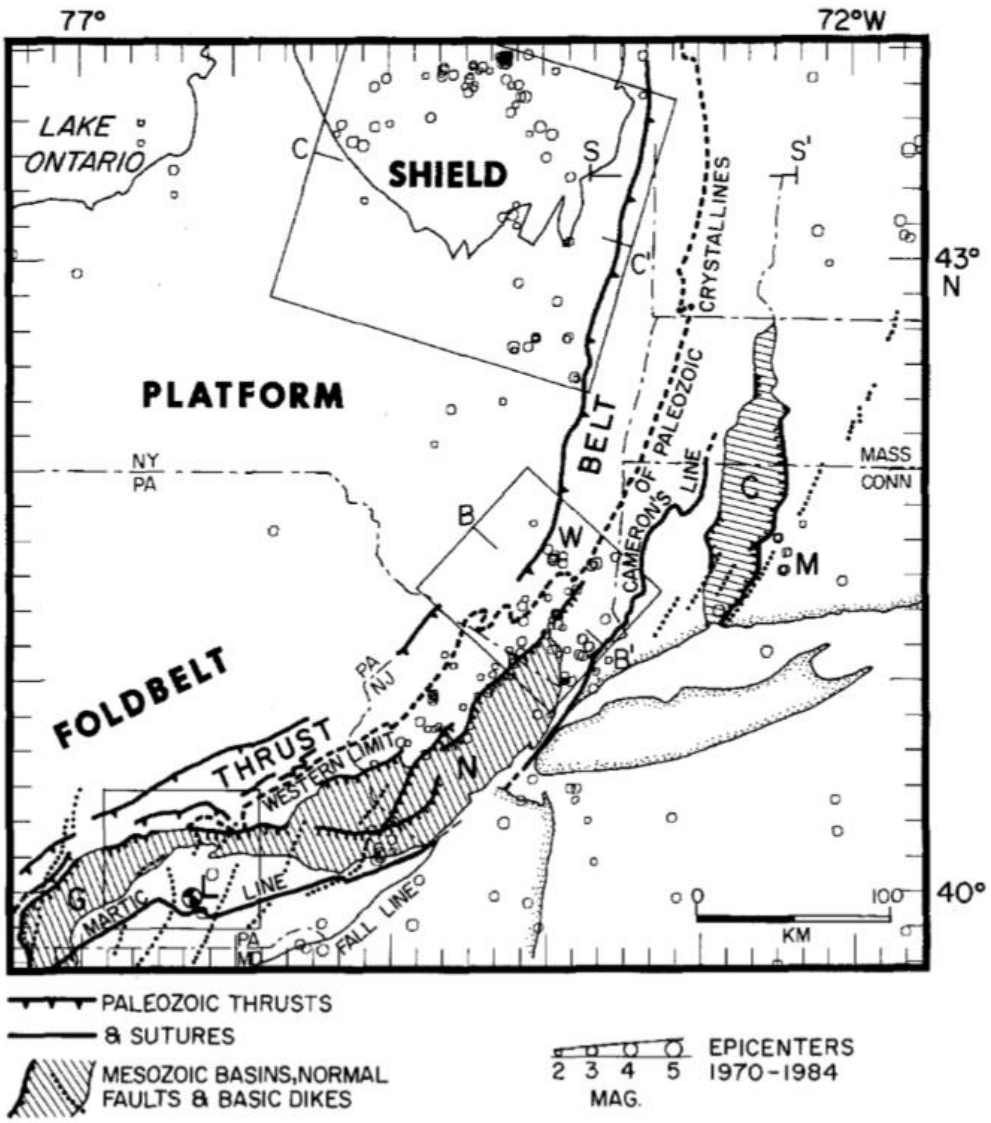


Figure 1.3: Geologic setting of the Newark Basin and Lancaster seismic zones. G and N represent the Gettysburg and Newark basins. (Armbruster and Seeber, 1987)

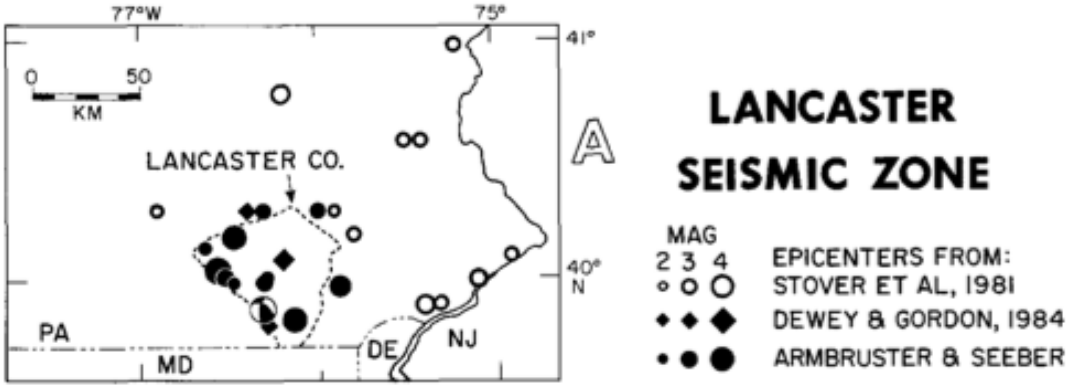


Figure 1.4: Depiction of the Lancaster Seismic Zone. Taken from Armbruster and Seeber (1987).

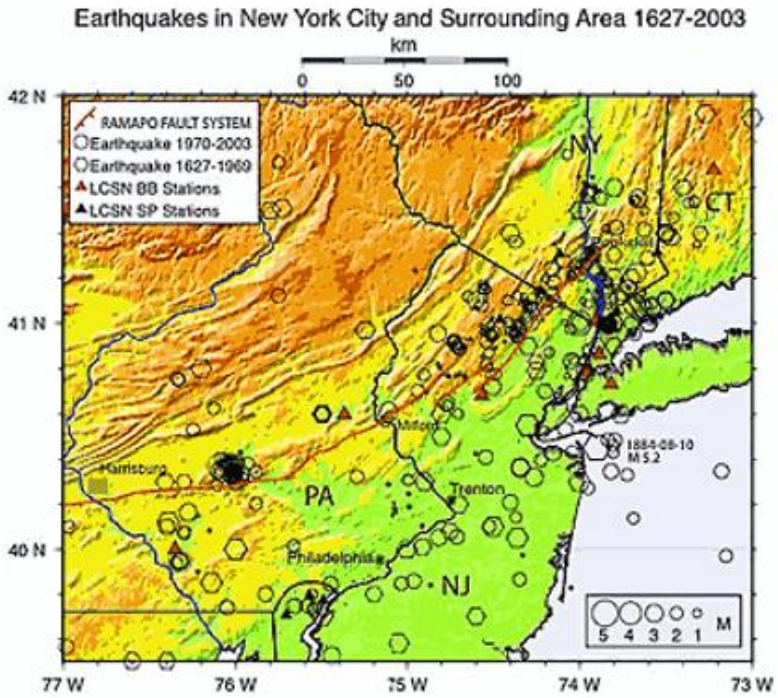


Figure 1.5: The Ramapo fault through New York, New Jersey, and Pennsylvania. (The Earth Institute - Columbia University (http://www.earthinstitute.columbia.edu/news/2004/story04-30-04b.html), 2004)

Although the LSZ and NBSZ are the best documented seismic zones in Pennsylvania, earthquakes have occurred in other areas of the state. For example, earthquakes have occurred along the western extension of the Ramapo fault in the Dillsburg area. In 2008 and 2009, a swarm of more than 800 earthquakes occurred, with 27 of them recorded on regional seismic stations (Jones et al., 2010). The Pymatuning event mentioned above occurred in the Appalachian Plateau near the Ohio border. The area surrounding the Pymatuning earthquake has few faults exposed at the surface, however, it was suggested that this event may have occurred on a northwest-southeast trending reactivated Precambrian basement structure (Maceira et al., 2000; Alexandrowicz and Cole, 1999). The August 15, 1991 magnitude 3.0 earthquake near Centre Hall also occurred outside of the LSZ and NBSZ (Clouser, 1992). Another potentially active fault system, the Transylvania system (Figure 1.6), consists of a series of east-west faults that extend through the Blue Ridge, Great Valley, and Valley and Ridge provinces. This fault system has also been mapped across the Appalachian Plateau based on geophysical and subsurface data (Root and Hoskins, 1977). Comparing the location of the Transylvania fault system and the historic seismicity in Figure 1.2 shows one earthquake possibly occurring in the area of this fault system.

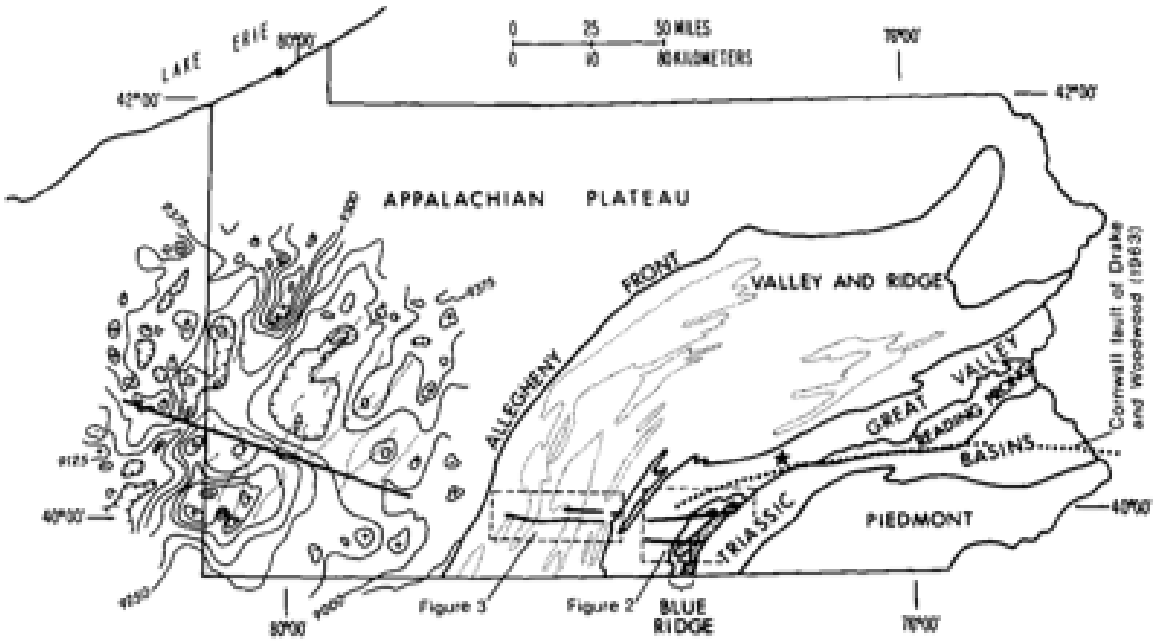


Figure 1.6: Map of Pennsylvania as shown by Root and Hoskins (1977). Heavy lines transecting the Blue Ridge - Great Valley show mapped faults that are part of the Transylvania fault system. The Heavy line across the Appalachian Plateau shows the extension of the Transylvania fault system based on aeromagnetic data and termination of subsurface structures.

Seismic Networks and Data

Data used in this study came from 101 broadband stations in five seismic networks that were in operation over the time period of the study (February 2013 – December 2014). Figure 1.7 shows the station locations, and a complete listing of the stations, together with station coordinates, instrumentation, and network codes, is provided in Appenix I. The ensemble of stations provides a station spacing of ~30 – 40 km across Pennsylvania. Details about the stations beyond what is summarized below can be obtained from the Incorporated Research Institutions for Seismology (IRIS) DMC metadata aggregator (http://ds.iris.edu/mda/network

code). All of the data used in this study are archived at the IRIS data management center (http://ds.iris.edu/ds/nodes/dmc/).

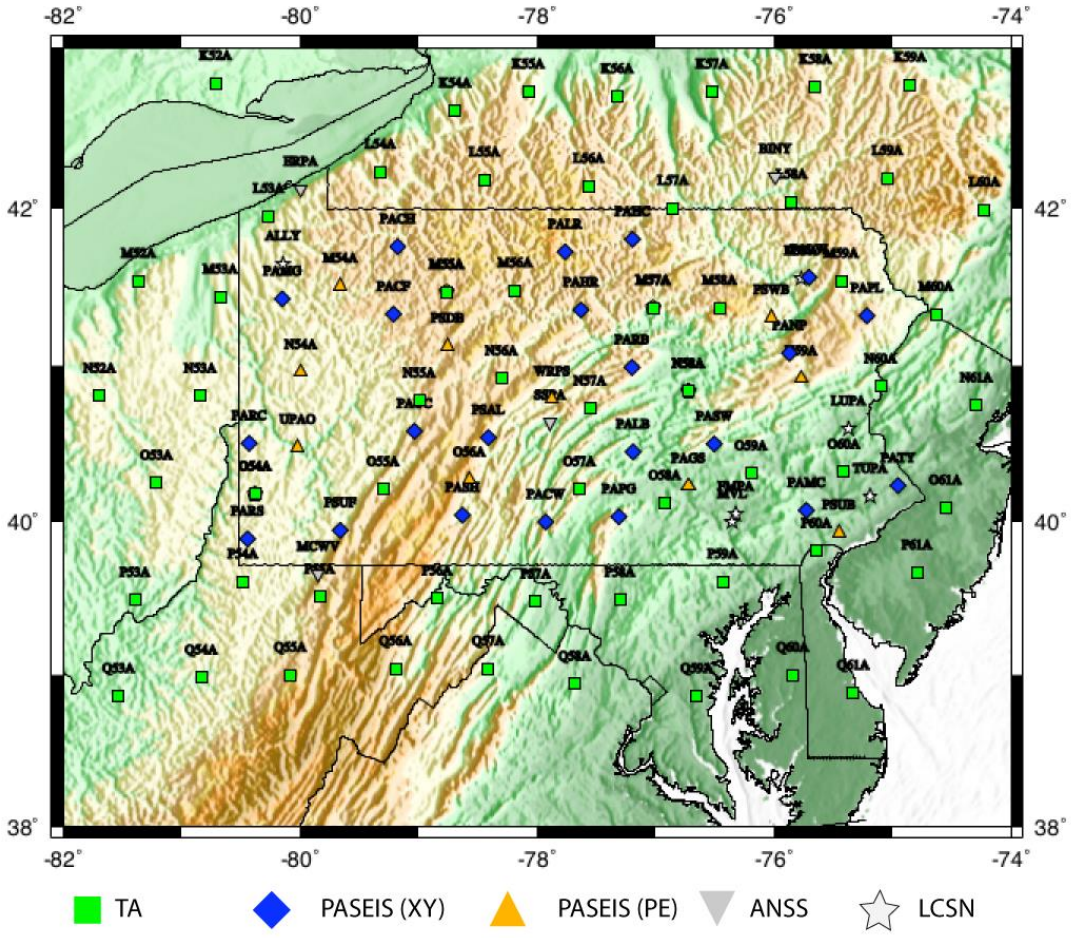


Figure 1.7: Seismic stations in and adjacent to Pennsylvania that were used in this study.

Advanced National Seismic System (Network codes IU and US)

The Advanced National Seismic System (ANSS) consists of two networks, the Global Seismographic Network (GSN) and the United States Seismic Network (USN). The GSN is operated jointly by IRIS and U.S. Geological Survey (USGS), and the USN is operated by the USGS. Four stations were used from the ANSS, two in Pennsylvania and two in neighboring states (Figure 1.7). Three of the stations (ERPA, BINY, and MCWV) belong to the USN and one station (SSPA) belongs to the GSN. The USN stations use Streckheisen STS-2 sensors with Quanterra 330 dataloggers. SSPA contains two sensors, a borehole sensor and a surface sensor. Data from the borehole sensor, a Geotech KS-36000-I, was primarily used, however, in the event that a suitable P-wave arrival time was unobtainable, data from the surface sensor, a Nanometrics Trillium 240, were also examined.

Permanent PASEIS (Network Codes PE and _PENN)

Penn State University, with support from the Pennsylvania Bureau of Topographic and Geologic Survey (BTGS), established a real time 3-component broadband seismic network beginning in 2006 for the Commonwealth. Over a period of several years, five stations were installed and combined with an existing station (WRPS) in the Department of Geoscience at Penn State to create the network. Four stations are at Penn State branch campuses and one is located at the BTGS headquarters in Middletown, PA. These six stations are equipped with Guralp CMG3T sensors and Guralp DM24 dataloggers. In 2010, an additional four stations were added to the network by advanced purchase of TA stations N54A, M54A, O56A, and N59A (Figure 1.7).

Information about the permanent PASEIS network can be found with two network codes. The first network code, PE, contains the six initial stations in the network. The second, _PENN, is an IRIS virtual network that contains the six PE stations as well as the four advanced purchase TA stations. The advanced purchase TA stations will be operated by IRIS through June 2016, and beginning in July 2016 they will be operated by Penn State.

Lamont-Doherty Cooperative Seismographic Network (Network Code LD)

Lamont-Doherty Earth Observatory operates a 40-station seismic network in the northeastern U.S. (Lamont-Doherty Cooperative Seismograph Network; LCSN), which is supported by the USGS. There are six LCSN station in Pennsylvania, and data from all six have been used in this study (Fig. 1.7). The stations are equipped with a Guralp CMG 3ESP, a Guralp CMG 40T, or a Nanometrics Trillium 120P sensor. Dataloggers used at the stations are either RefTek RT130 or Quanterra Q730 models.

USArray Transportable Array (Network Code TA)

The majority of the stations used in this study were part of the USArray Transportable Array (TA). Data were used from 20 stations located in Pennsylvania and 43 stations in neighboring states (Fig. 1.7). The TA network started in August 2007 in the western United States and migrated eastward, reaching western Pennsylvania in late 2012. Station spacing for the TA was approximately 70 km, with the stations deployed in a grid pattern. TA stations in Pennsylvania recorded data for an average of 22.6 months. The first TA station was installed in Pennsylvania in December 2012 and the last TA station was installed in August

2013. Demobilization of the stations in Pennsylvania started in October, 2014 and was completed in May, 2015. The TA stations were equipped with Quanterra 330 dataloggers and either Guralp CMG3T, Streckheisen STS-2, or Nanometrics Trillium 240 sensors.

Temporary PASEIS (Network Code XY)

In order to reduce station spacing to ~30 - 40 km and increase the level of seismic detection, deployment of the PASEIS temporary network began in early 2013. Twenty-one stations were installed between February 2013 and May 2013 and one station was installed in August 2013 (Figure 1.7). Twenty stations were located at state parks and two stations at Penn State branch campuses. The stations were equipped with Nanometrics Compact Trillium sensors and RefTek RT130 dataloggers. The equipment belongs to the BTGS and was purchased in 2009 for a previous project. Stations were visited every 3-4 months for data downloading. Data processing information is given in Appendix B.

Seismic Event Locations and Magnitudes

Seismic data digitized at either 40 or 100 samples per second were used for locating seismic events and estimating magnitudes. The Antelope Environmental Data Collection Software suite (Antelope) was used to pick P-wave arrival times and obtain initial locations. S-wave arrivals were not picked. The methods used are similar to the methods outlined in the Antelope New Users Guide (Lockridge et al., 2012), except that the automated event detection and location codes described in

the Users Guide were not used.

Antelope's dbpick program was used to visually scan continuous waveform data from the 101 stations. The data were filtered with a Butterworth bandpass filter with corner frequencies of 1 and 5 Hz. P wave arrival times were then manually picked to within 0.1 seconds on the filtered seismograms. Preliminary hypocenters were found by using Antelope's dblocsat2 program and the IASP91 (Kennett and Engdahl, 1991) velocity model. Dblocsat2 uses an iterative non-linear inverse technique where the least-squares inversion is performed via a singular value decomposition method (Bratt and Bache, 1988). To further refine event locations, events were relocated using the HYPOELLIPSE (Lahr, 1989; Lahr, 1999) program and a velocity model adopted from Katz (1955) for Pennsylvania (Table 1.1). HYPOELLIPSE uses Geiger's method (Geiger, 1912; Lahr, 1989; Lahr, 1999), an iterative least-squares method, to determine hypocenter location. Local magnitudes (M_L) were determined using Antelope's dbevproc algorithm. This algorithm follows Richter's (1935) method, where the largest amplitude on the 3-component data is used. The correction factor applied for epicentral distance used by Antelope is given in Table 1.2.

Locations were obtained using a minimum of four P-wave arrival times, but the average number of stations used was 10. Residuals for P-wave travel times were generally less than 1 second, although a few arrival times had residuals between 1 and 2.5 seconds. The average residual was 0.03 seconds, and the average overall root mean square (RMS) travel time residual for the catalog is 0.53 seconds. The RMS results from uncertainties in P-wave arrival times and the velocity model.

The catalog (PASEIS catalog; Appendix C) contains details of seismic event locations and magnitudes. Event origin time information is given to within 0.01 seconds. An azimuthal gap is reported, which is the largest number of degrees azimuthally between adjacent stations. Generally, a smaller azimuthal gap corresponds to a more reliable epicentral event location. The RMS (root mean square) value listed in the catalog is the overall RMS residual of the travel time picks used in the location. An error ellipse provides a minimum estimate of the event location uncertainty. The error ellipse is computed using a 68% confidence bound and one degree of freedom. SEH are the two horizontal axes (in km) of the ellipse and SEZ is the vertical axes (in km).

Table 1.1: Velocity model used for Hypoellipse location, adapted from Katz (1955)

Layer	P-wave Velocity (km/s)	Depth of interface (km)	Vp/Vs ratio
1	6.0	0.0	1.74
2	6.3	10.0	1.74
3	6.6	20.0	1.74
4	6.9	30.0	1.74
5	8.1	37.0	1.74

Table 1.2: Correction factors as a function of distance for Richter's magnitude calculation

Distance (km)	Correction Factor	Distance (km)	Correction Factor
0	1.4	260	3.8
5	1.4	270	3.9
10	1.5	280	3.9
15	1.6	290	4

20	1.7	300	4
25	1.9	310	4.1
30	2.1	320	4.1
35	2.3	330	4.2
40	2.4	340	4.2
45	2.5	350	4.3
50	2.6	360	4.3
55	2.7	370	4.3
60	2.8	380	4.4
65	2.8	390	4.4
70	2.8	400	4.5
80	2.9	410	4.5
85	2.9	420	4.5
90	3	430	4.6
95	3	440	4.6
100	3	450	4.6
110	3.1	460	4.6
120	3.1	470	4.7

130	3.2	480	4.7
140	3.2	490	4.7
150	3.3	500	4.7
160	3.3	510	4.8
170	3.4	520	4.8
180	3.4	530	4.8
190	3.5	540	4.8
200	3.5	550	4.8
210	3.6	560	4.9
220	3.65	570	4.9
230	3.7	580	4.9
240	3.7	590	4.9
250	3.8	600	4.9

Results

The seismic event catalog obtained from this study (Appendix C) contains 1568 events, 1355 of which are located within Pennsylvania (Figure 1.8). Events outside of the state are mostly situated near the border, and were located to

determine whether or not they fell within the boundaries of the state.

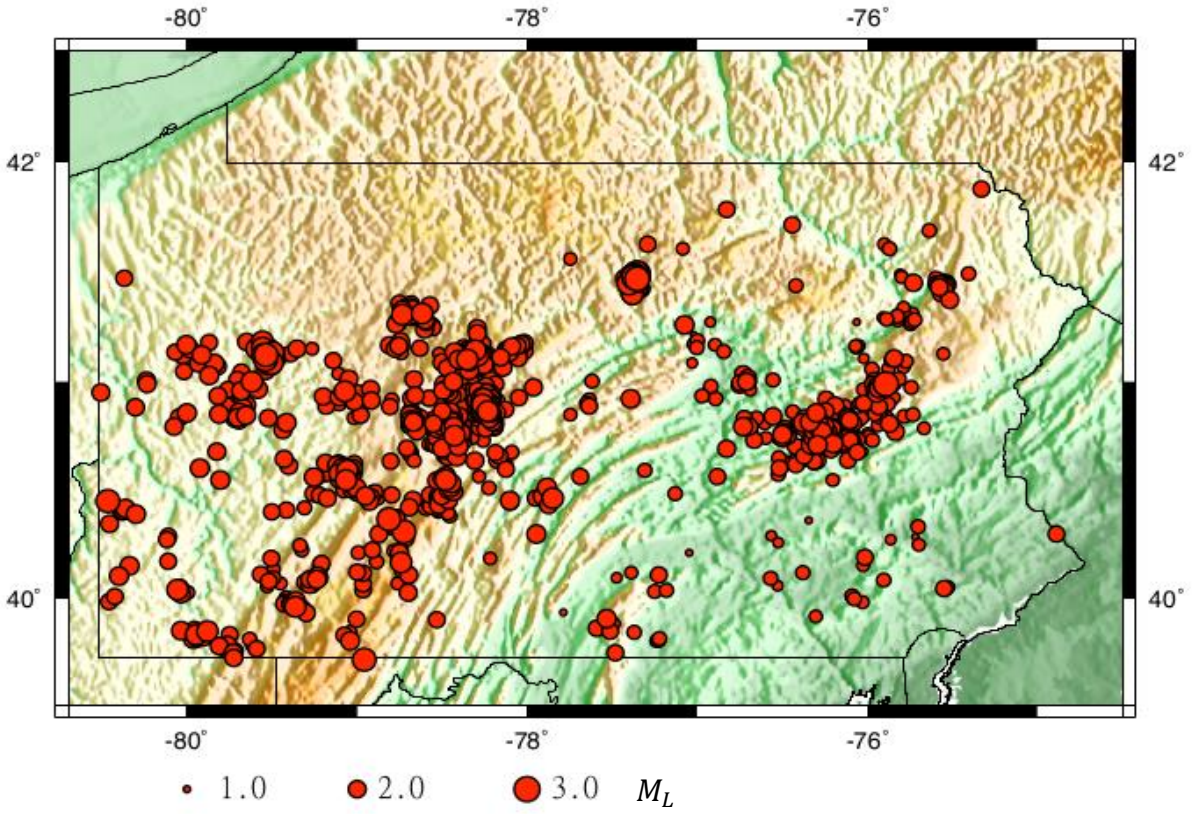


Figure 1.8: Seismic event locations in Pennsylvania, February, 2013 - December, 2014

Epicentral locations for all events in Pennsylvania are well constrained, as indicated by the average horizontal error ellipse axis of < 0.39 km. In addition, depths for 928 of the Pennsylvania events are determined to be well constrained, with an average depth uncertainty of 1.17 km. However, the remaining events in the catalog have depth uncertainties > 5 km. There is a trade-off between hypocentral depth and origin time so it is possible that the origin time of events with poorly constrained depths is inaccurate. However, most of these events have source depths of 0 km, and if they are mine blasting events then the origin time would be accurate. Event depth distribution for the 928 events with well-constrained source depths can be seen in Figure 1.9.

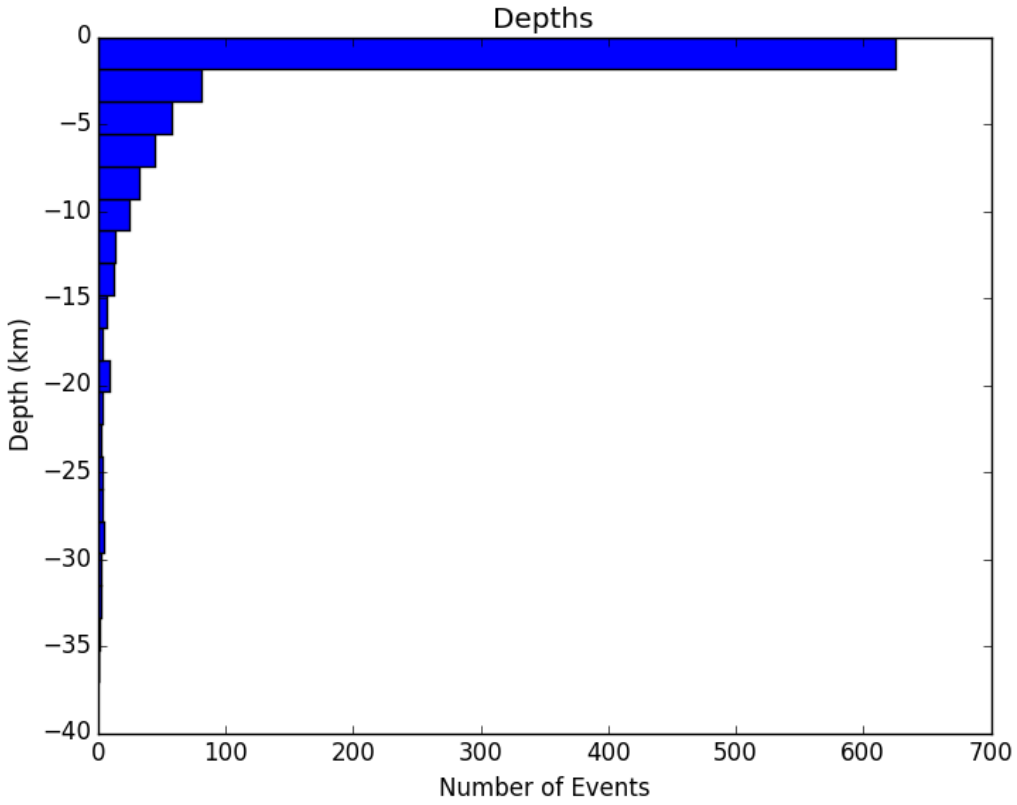


Figure 1.9: Depth distribution of hypocenter locations for the PASEIS catalog.

Magnitude calculations resulted in an average local magnitude (M_L) of 1.92 with a range between 1.07 and 2.89 (Figure 1.10). Using the Maximum Curvature (MAXC) technique of Wiemer and Wyss (2000) and the Gutenberg-Richter plot (Figure 1.11), the magnitude of completeness (M_C) of the catalog was determined to be 2.0. For this M_C value, the corresponding b-value of the catalog is 2.63.

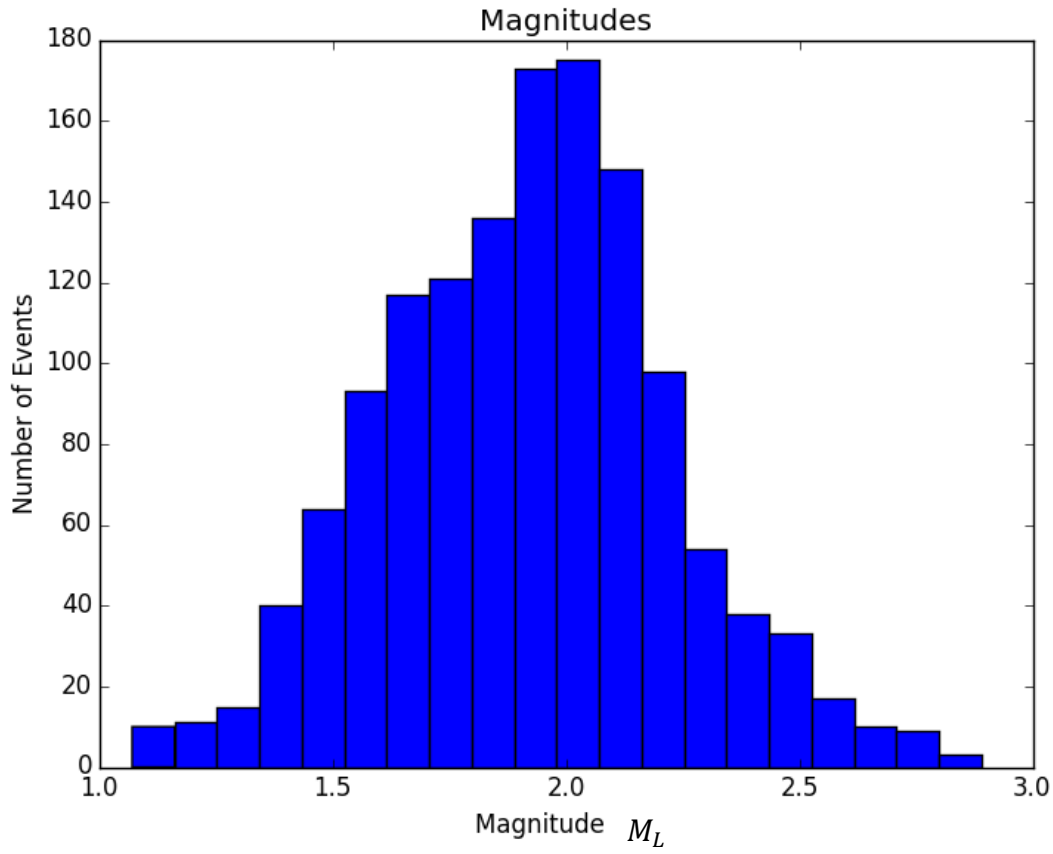


Figure 1.10: Magnitude distribution for the PASEIS catalog.

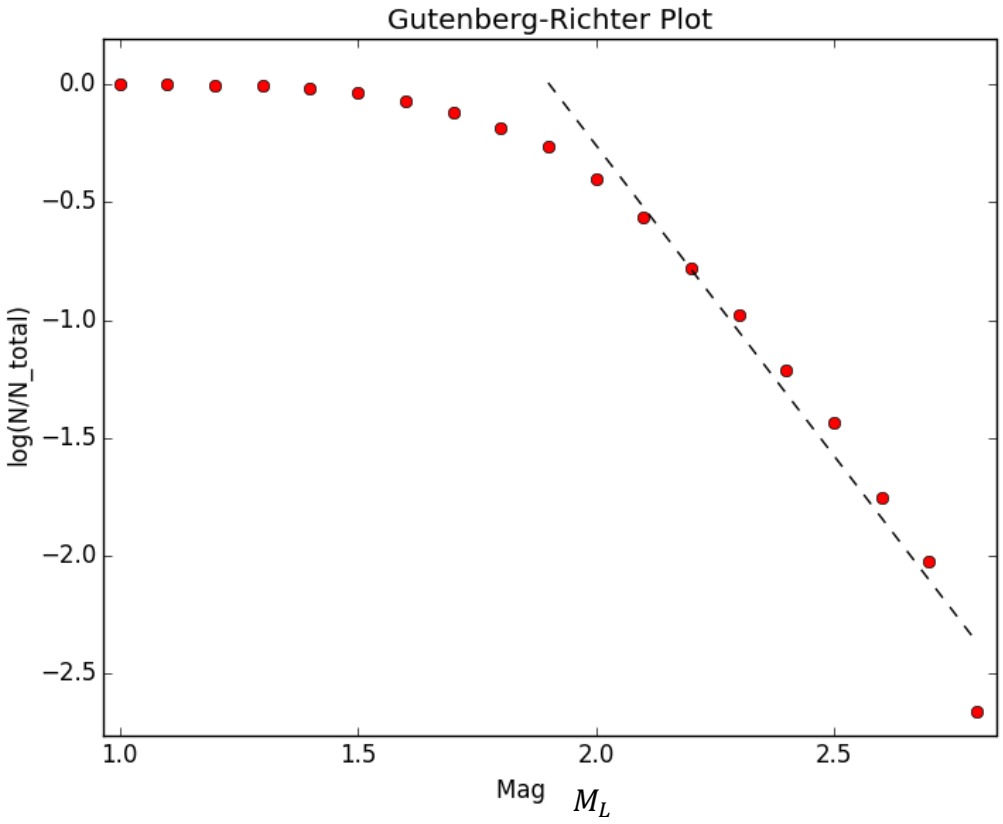


Figure 1.11: Gutenberg-Richter plot for the PASEIS catalog. The b-value is 2.63.

Richter's (1958) methodology was developed for southern California where the seismic attenuation is higher than in the eastern U.S. Astiz et al. (2014) compared the USArray Network Facility catalog (ANF) magnitudes (M_R), which are also based on Richter's method, with local magnitude scales in the eastern U.S. Using the LCSN's M_L, they showed that Richter magnitude estimates could be biased upwards in the eastern U.S by 0.5 magnitude units (Figure 1.12). This finding is relevant for this study, given that the TA makes up a large portion of the stations used. Consequently, the local magnitudes reported in this study may be about half a magnitude unit too high, in which case the catalog may be complete to M_L 1.5

instead of 2.0. The b-value obtained, 2.63, is much higher than the expected b-value of 1.0 for tectonic earthquakes. b-values for events associated with mine blasts typically are typically greater than 1.5 (Weimer and Baer, 2000), which suggests that the catalog may be dominated by mining-related seismic events.

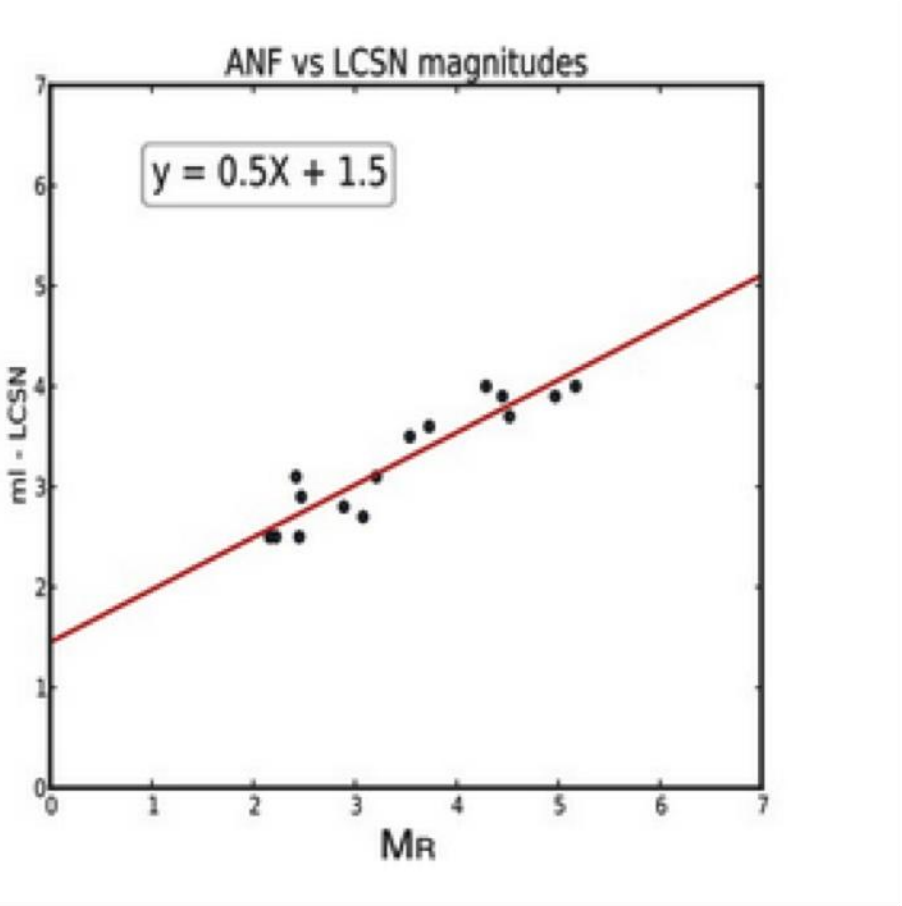


Figure 1.14: Comparison of east coast local magnitude scale from the LCSN to the original Richter magnitude (Astiz et al., 2014).

Origin times for the Pennsylvania events occur primarily between 12:00 and 22:00 UTC (8 am and 6 pm EST) (Figure 1.13) and the majority of the events occur Monday through Friday, with significantly fewer events on weekend days (Figure

1.14). The number of seismic events located each month is shown in Figure 1.15, and range between about 40 and 100.

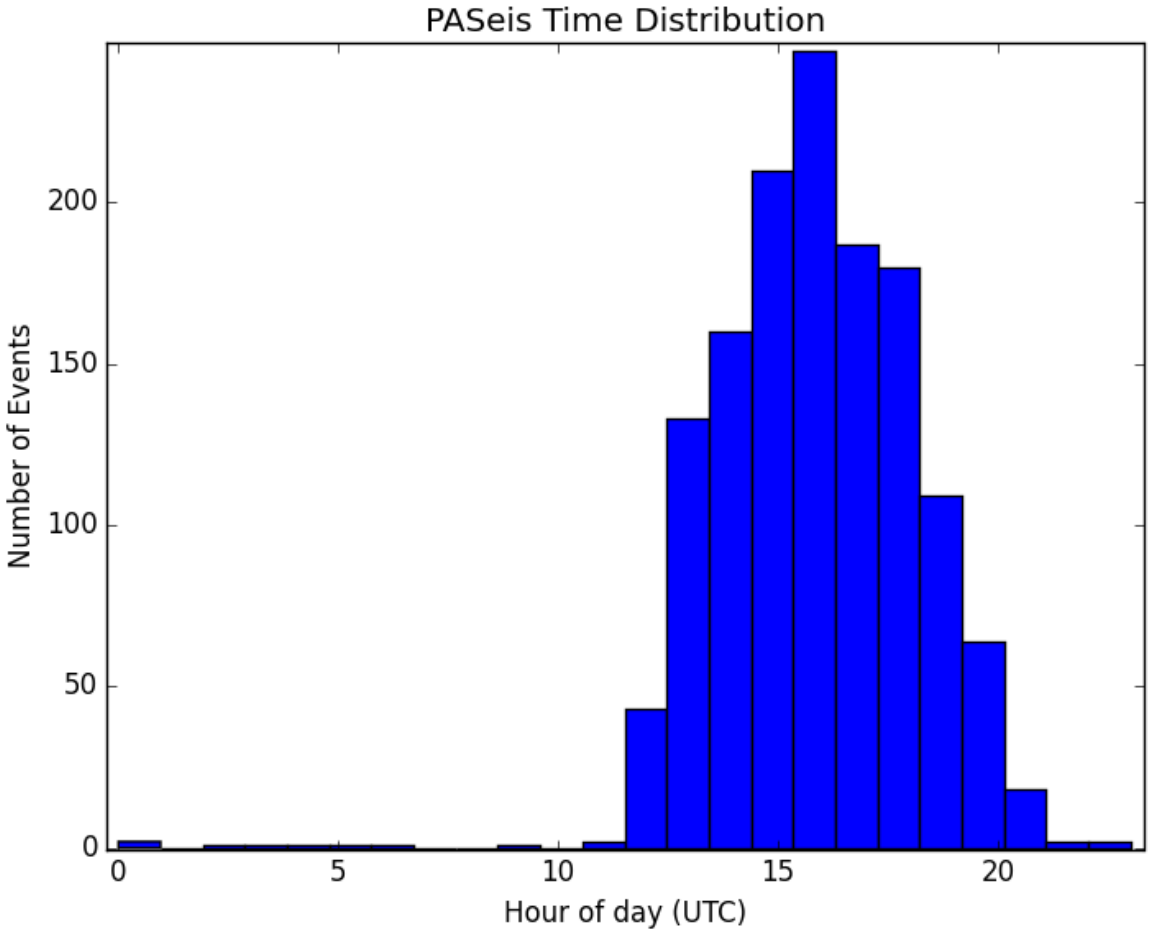


Figure 1.13: Time distribution of PASEIS events. Peak time occurs approximately at 16:00 UTC (12:00 pm EST).

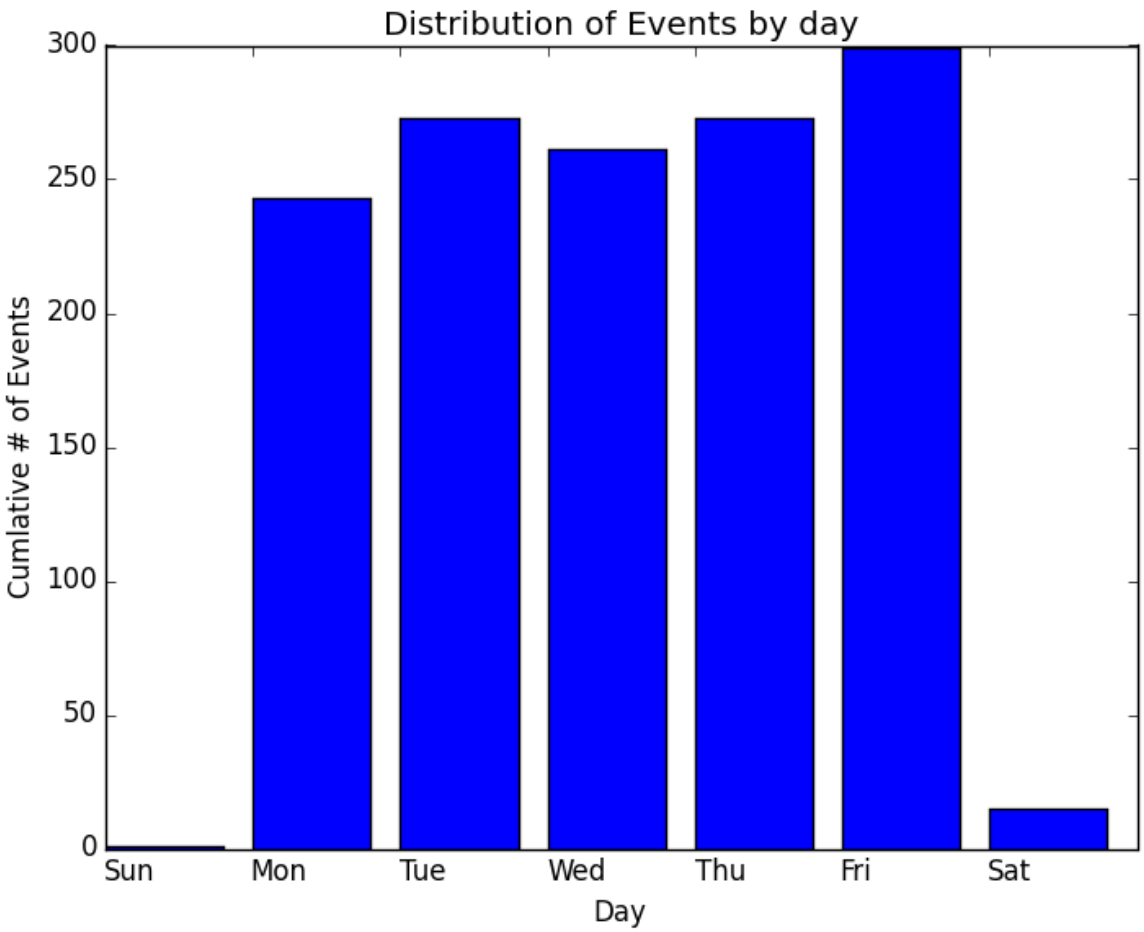


Figure 1.14: Days of the week distribution for PASEIS events.

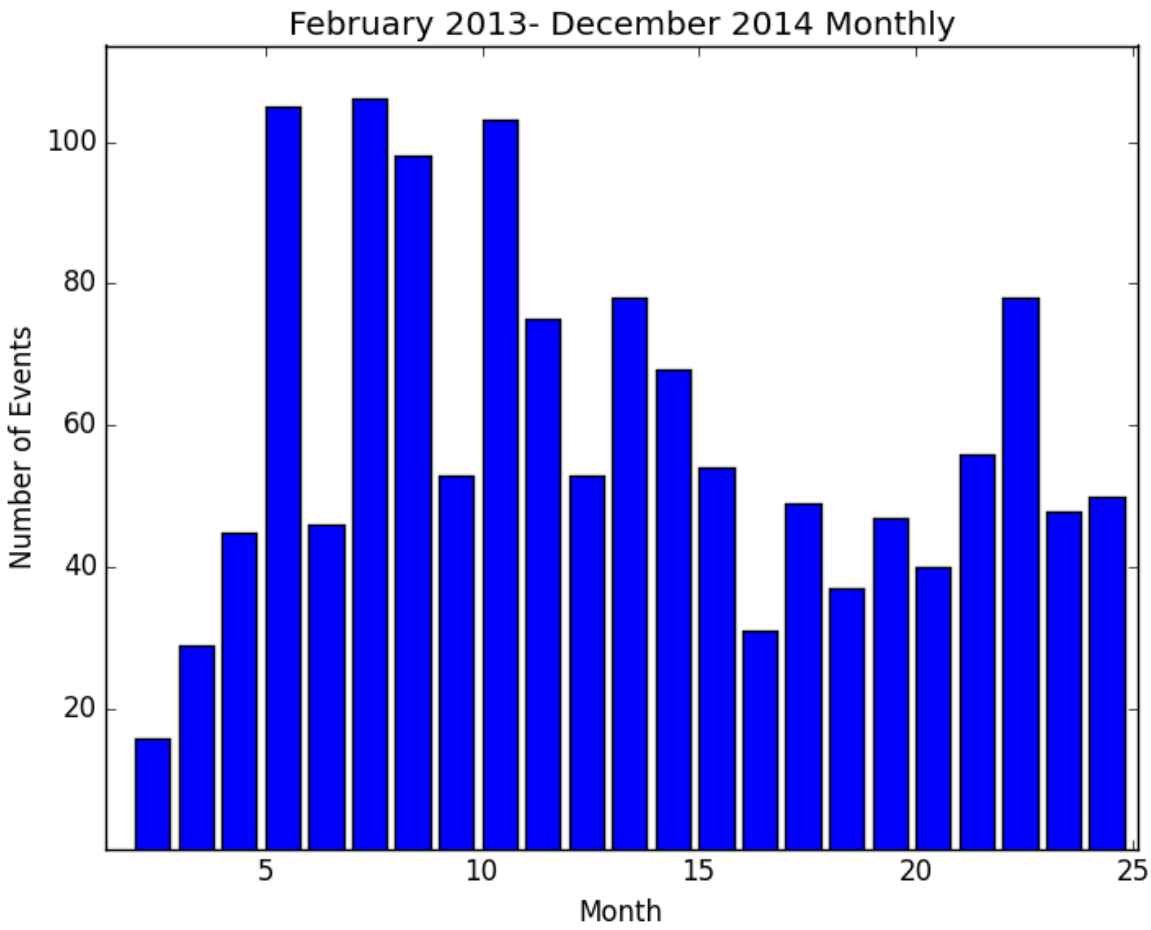


Figure 1.15: Monthly distribution of seismic events determined from February, 2013 to December, 2014

The USArray's Network Facility (ANF)

The ANF catalog contains locations for 114 events in Pennsylvania between March 2013 and July 2014 (events for September 2013 and later than July 2014 are not yet available). Eighty-seven of these events are also in the PASEIS catalog. Of the 27 events located by ANF that are not in the PASEIS catalog, 14 events were near the border of the state, where the station coverage used in this study diminishes.

Locations and magnitudes are similar between both catalogs. A comparison of event locations can be seen in Figure 1.16 and a magnitude comparison can be seen in Figure 1.17.

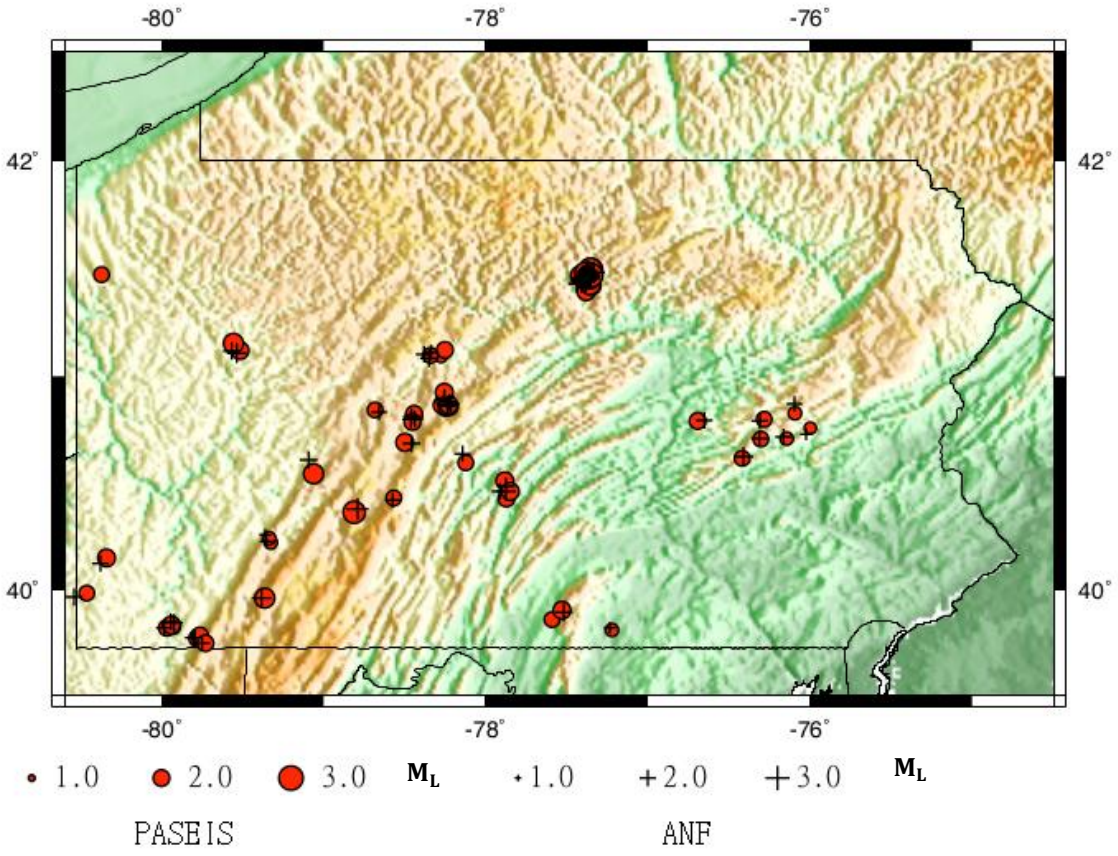


Figure 1.16: Comparison of event locations between the PASEIS and ANF catalogs.

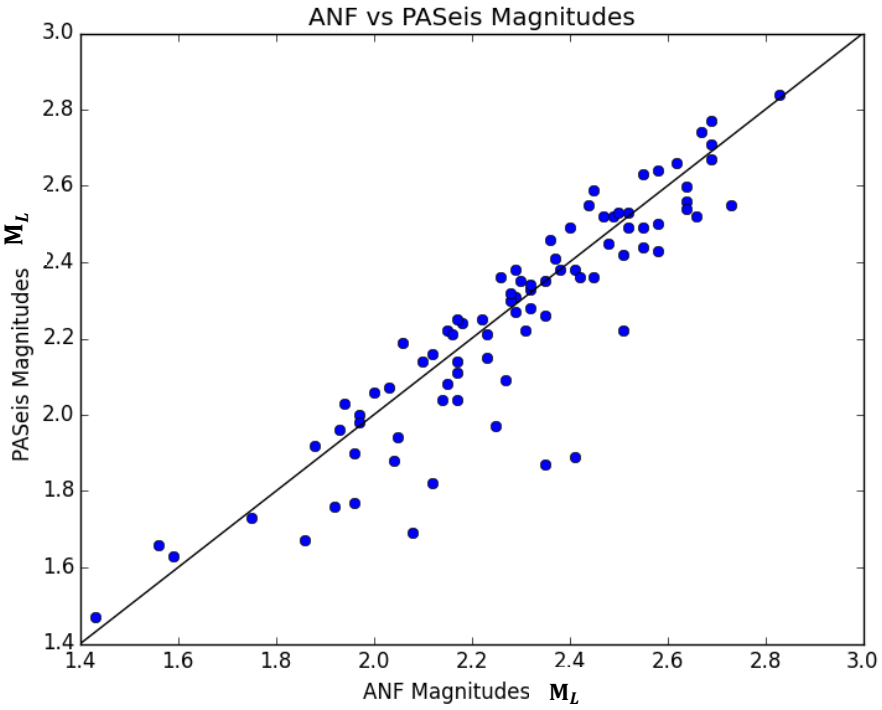


Figure 1.17: Comparison of magnitudes between PASEIS and ANF catalogs.

In addition to comparing the PASEIS catalog and the ANF catalog, the PASEIS catalog can also be compared with the USGS catalog. The USGS catalog contains four earthquakes and one quarry blast event in Pennsylvania for the time frame of the study. Locations and magnitudes for those events are comparable between the two catalogs. However, it is important to note that the USGS does not routinely report event locations for mining-related events, which could explain the lack of events in the USGS catalog compared to the PASEIS catalog.

Chapter 2

The Relationship Between Seismic Events, Natural Resource Extraction and Earthquakes

Introduction

The analysis of the seismicity catalog in Chapter 1 showed a strong bias towards events occurring on weekdays and during working hours (Figures 1.13, 1.14, 1.15). The Gutenberg-Richter analysis also yielded a b-value of 2.63. The b-value and timing distributions combined suggest that the seismicity catalog is dominated by mining events. In this chapter, further analysis of the event data is performed to identify the mining-related events from other events. Following this, the resulting events are examined for evidence of induced events from natural gas extraction activity. Through this process, the subset of tectonic earthquakes in the catalog is determined.

Spatial Correlation of Events with Mine Locations

To investigate whether seismic events in the catalog are associated with mining activity in Pennsylvania (Figure 2.1), mine locations were gathered from the Pennsylvania Department of Environmental Protection open reports on bituminous coal, anthracite coal, and industrial minerals production. To date, only reports for

2013 are available. Figures 2.2 and 2.3 show a strong visual correlation between event and mine locations. This correlation is particularly evident between the locations of bituminous and anthracite coal mines, but also is seen with industrial mineral quarries.

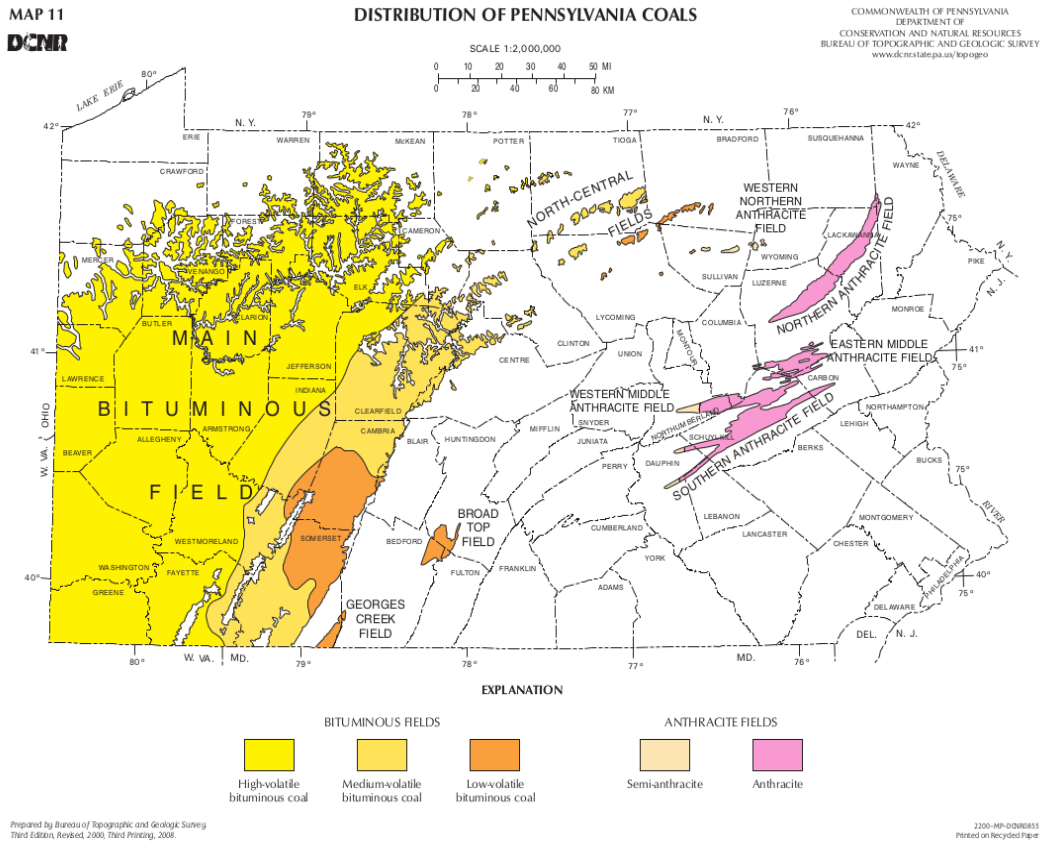


Figure 2.1: Coal fields of Pennsylvania (PA DCNR, 2013)

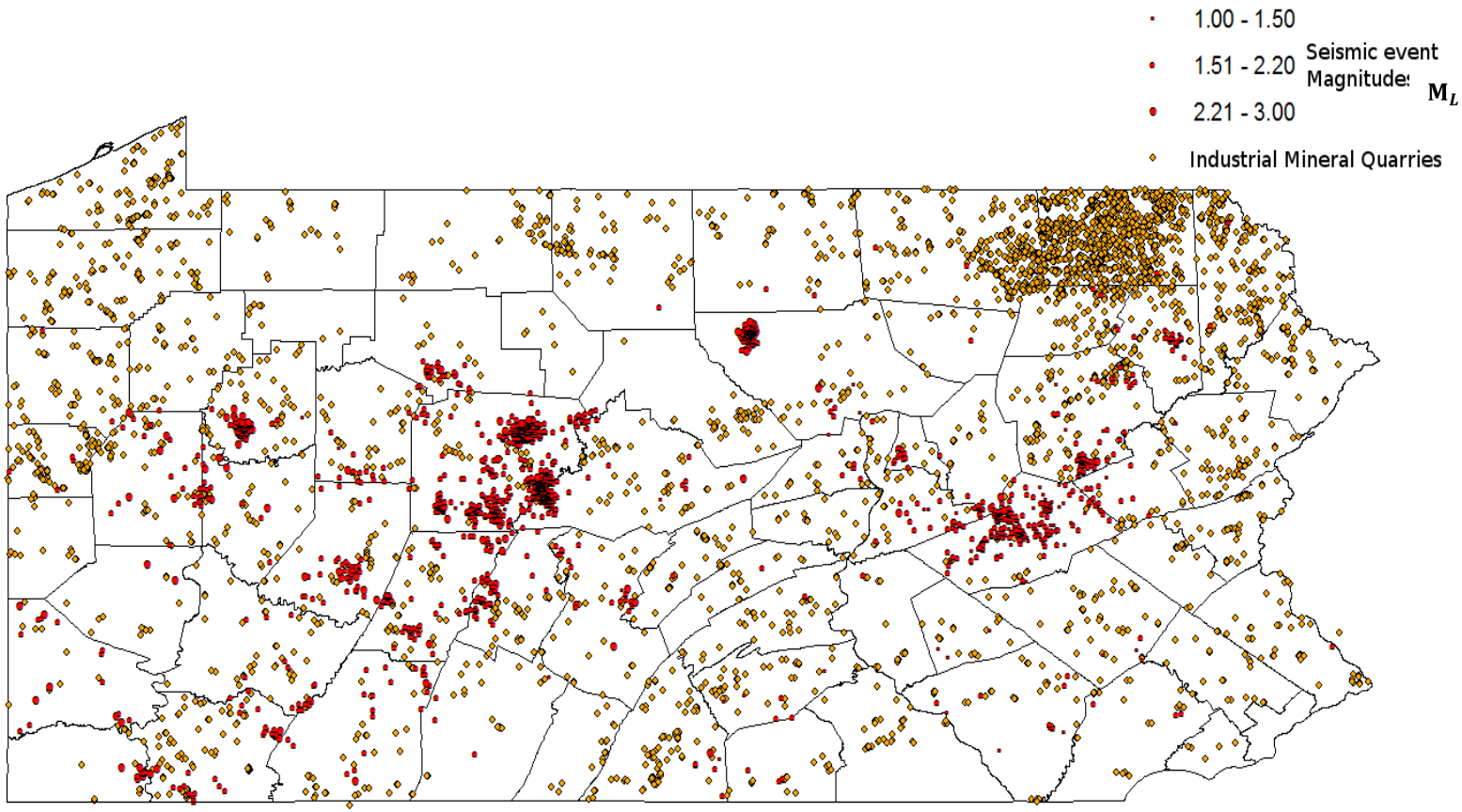


Figure 2.2: Map showing PASEIS catalog events and industrial mineral quarries (PA DCNR, 2014).

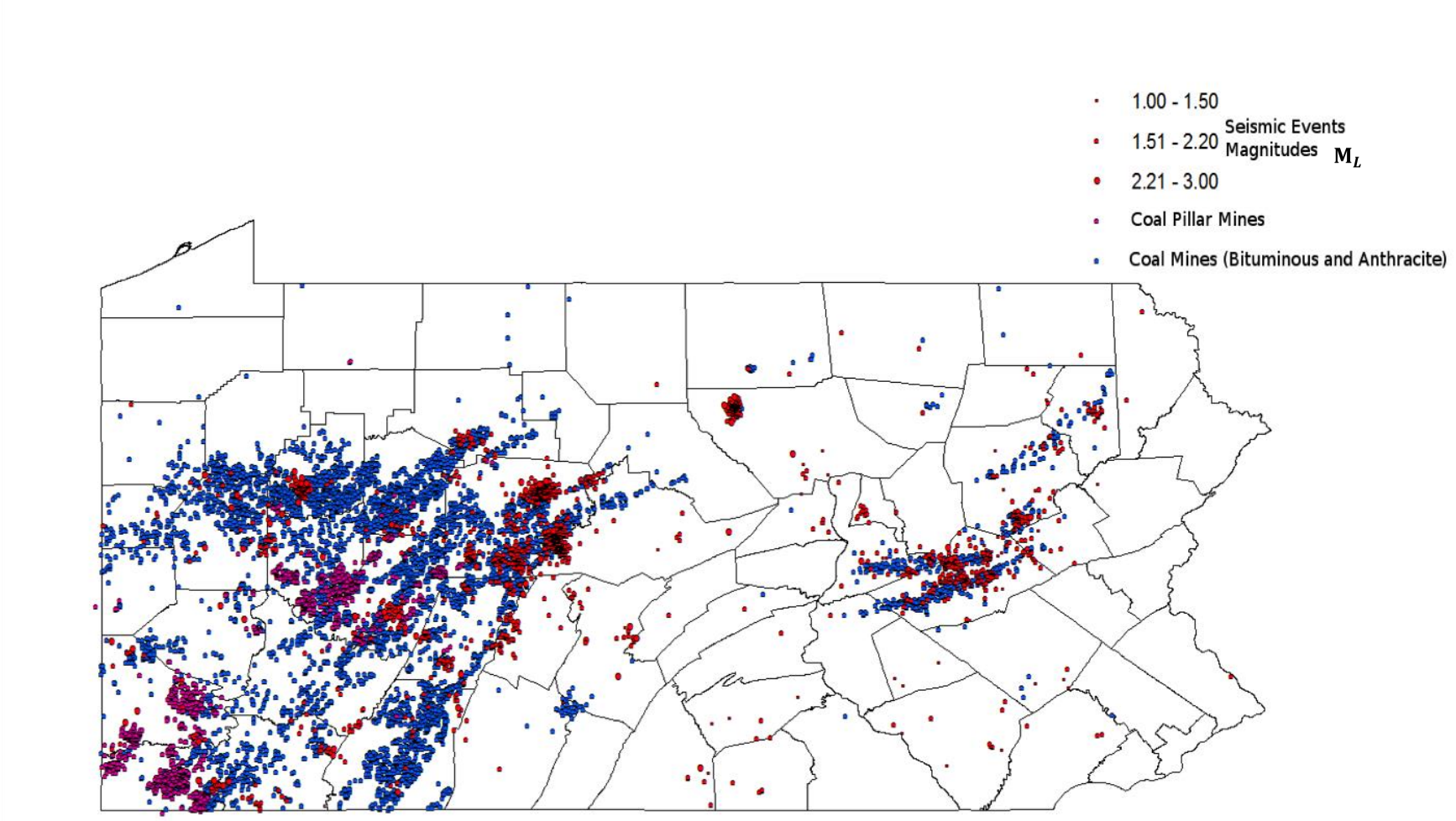


Figure 2.3: Seismic events from February 2013 - December 2014 plotted with coal mine locations (PADCNR, 2014).

Classifying Events in the PASEIS Catalog

The United State's Geological Survey (USGS) lists several criteria that can be used to identify mining seismicity (http://earthquake.usgs.gov/earthquakes/eqarchives/mineblast/evidence.php). The criteria include:

1. Locations of events with respect to mines and quarries
2. Time of Day
3. Waveform Characteristics
4. Events not reported as felt where similar magnitude earthquakes usually would be reported

Therefore, in order to further understand the source of the seismicity, waveform characteristics and event-to-mine distances have been visually examined for every event in the catalog.

Waveform characteristics of blasting can include (1) similar waveshape from event to event at a given station (phase arrivals, times, and amplitudes), (2) emergent phase arrivals or multiple P arrivals, (3) lack of clear S-wave arrivals, (4) the presence of the Rg phase, and (5) codas 25 seconds or longer on stations within 1 degree of an event epicenter (USGS, 2015; Lockridge et al., 2012). In addition, Lockridge et al. (2012) and Stump et al. (2002) note that excessive low-frequency signals can characterize mine blast events. Categorizing events based on the above criteria can be challenging, as not all the characteristics are present in the data. Furthermore, rockbursts, a type of earthquake related to the change in stresses near

mine openings, also tend to possess these characteristics (USGS, 2015). Waveform characteristics can also change depending on the type of blasting and the geology of the area. Before applying these criteria, the waveforms were filtered with a 1-10 Hz bandpass filter.

The distance between events and mines/quarries was also further examined using Google Earth satellite imagery. Although the minimum horizontal error shown by the axis of the error ellipse may be small for an individual event, a distance of 5 km between a mine/quarry and an event location is used as the cut off in categorizing events as mine/quarry blasts. Using a 5 km distance takes into account the difficulty of accurately locating some events with emergent phase arrivals.

Seismic events in the catalog have been classified as mining/quarry blasting events if one or more of the waveform characteristics are met and if the event epicenter is within 5 km of a mine/quarry. Potential blasting events have been identified as events where the waveform characteristics met the blasting criteria, however, in examining the Google Earth satellite imagery, no evidence of nearby mining activity was found (Lockridge et al., 2012). Figure 2.4 show data from two events that illustrate the waveform characteristics, such as emergent arrivals and excessive low-frequency signal, used to identify mining-related events, and Figure 2.5 illustrates typical non-mining event signals. Spectra for the events in Figure 2.4 and 2.5, from several stations, are shown in Appendix D.

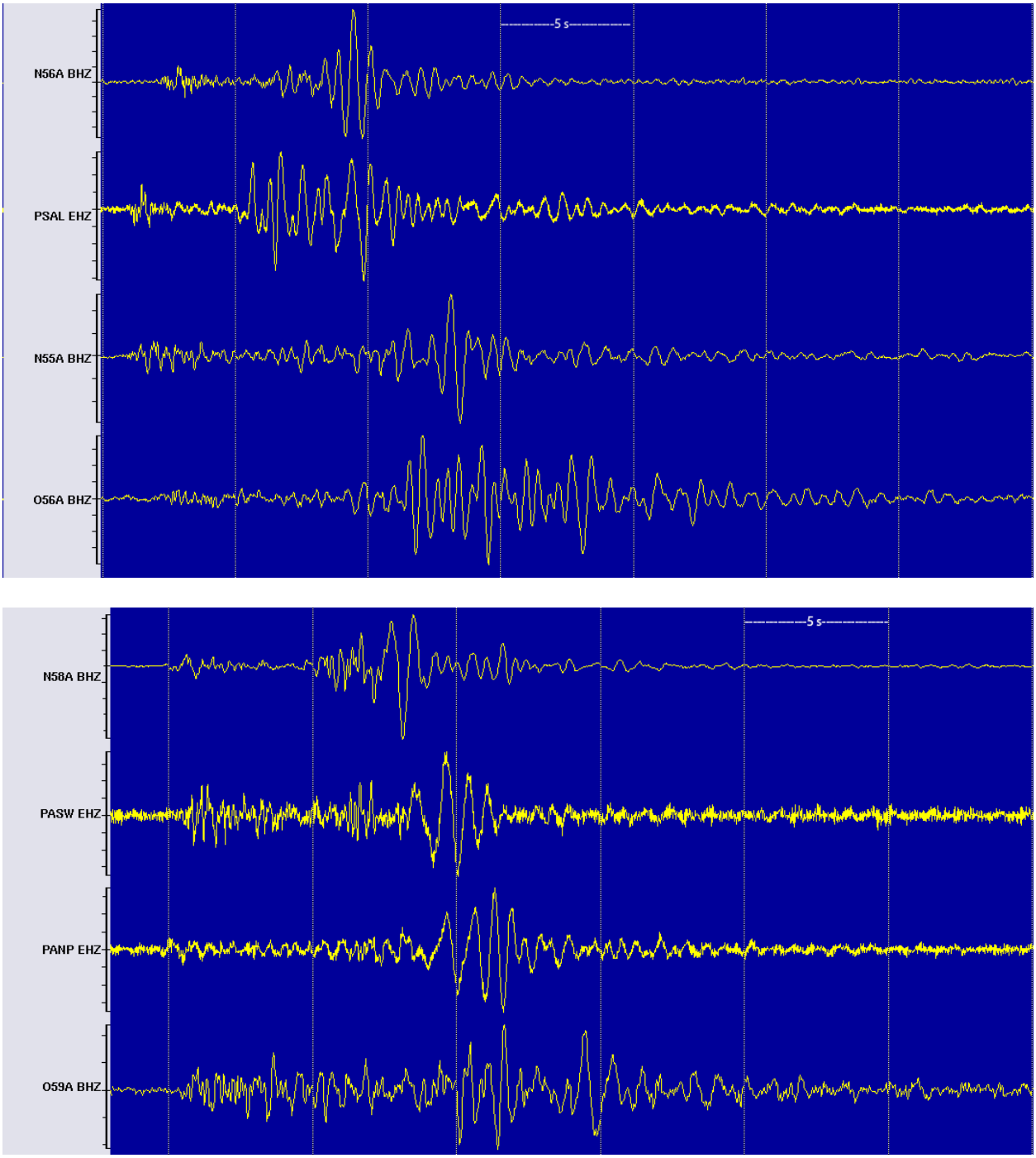


Figure 2.4: Selected velocity seismograms illustrating a typical event characterized as a blast. Traces are from the four nearest stations and filtered from 1-10 Hz. (Top) December 30, 2013 event near Madera, PA. (Bottom) April 7, 2014 near Pottsville, PA

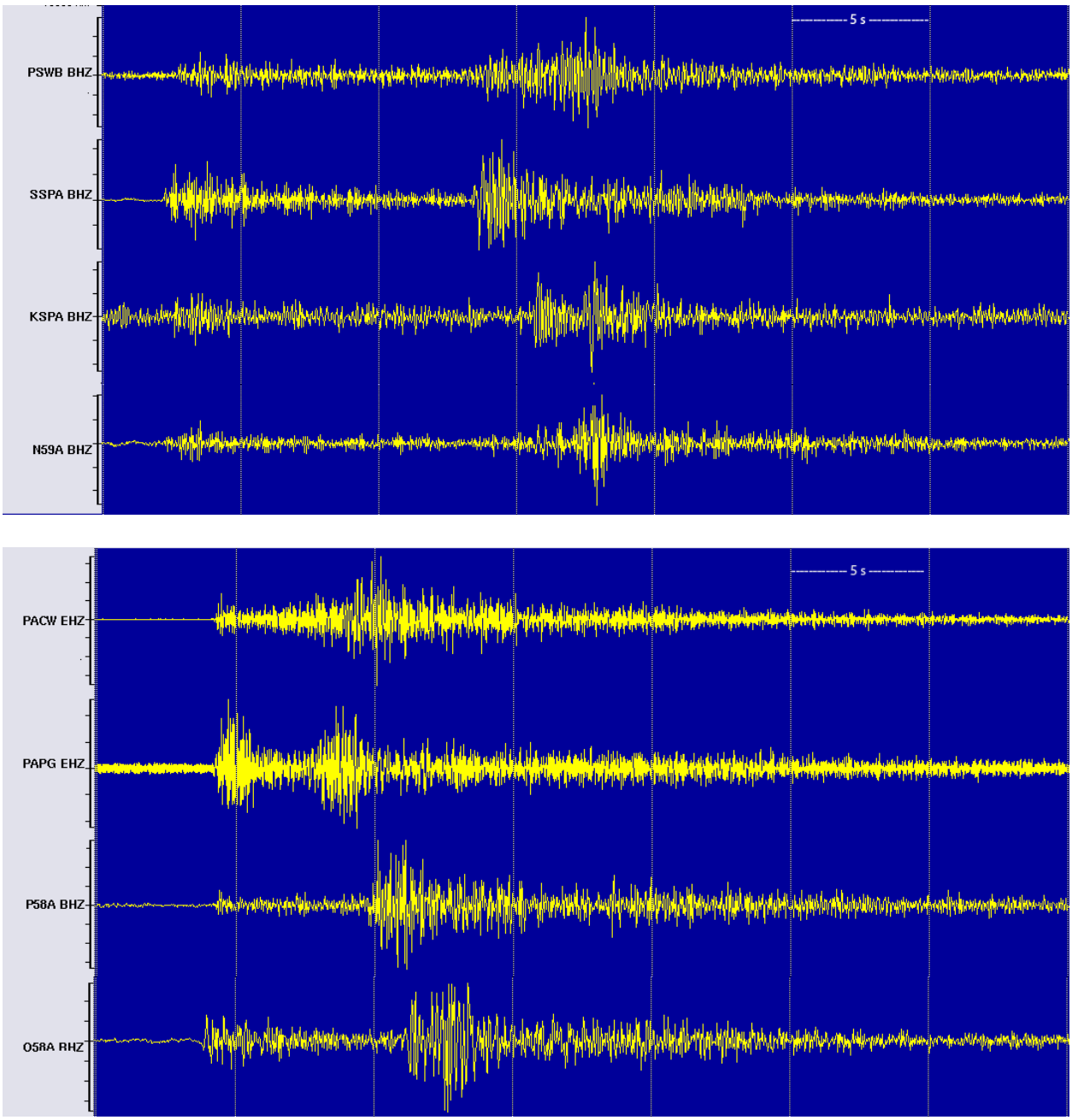


Figure 2.5: Selected velocity seismograms illustrating a typical event characterized as a non-mining event. Traces are from the four nearest stations and filtered from 1-10 Hz. (Top) February 19, 2013 event in Williamsport, PA. (Bottom) July 16, 2013 event near Chambersburg, PA.

After applying the waveform and event-mine distance criteria, 1117 events were classified as mine/quarry blasts (Figure 2.6). These events primarily occur in the bituminous and anthracite coal mining regions of the state, however, they also coincide with some industrial mineral quarries. Stump et al. (2002) list surface coal mining and open pit metal mining as using the largest amount of explosives per blast, with surface coal mining typically using 500 tons and above in the U.S. In addition, 165 events were identified as potential blasts (Figure 2.7). Consequently, the PASEIS seismic event catalog consists predominantly of events resulting from mine/quarry activity.

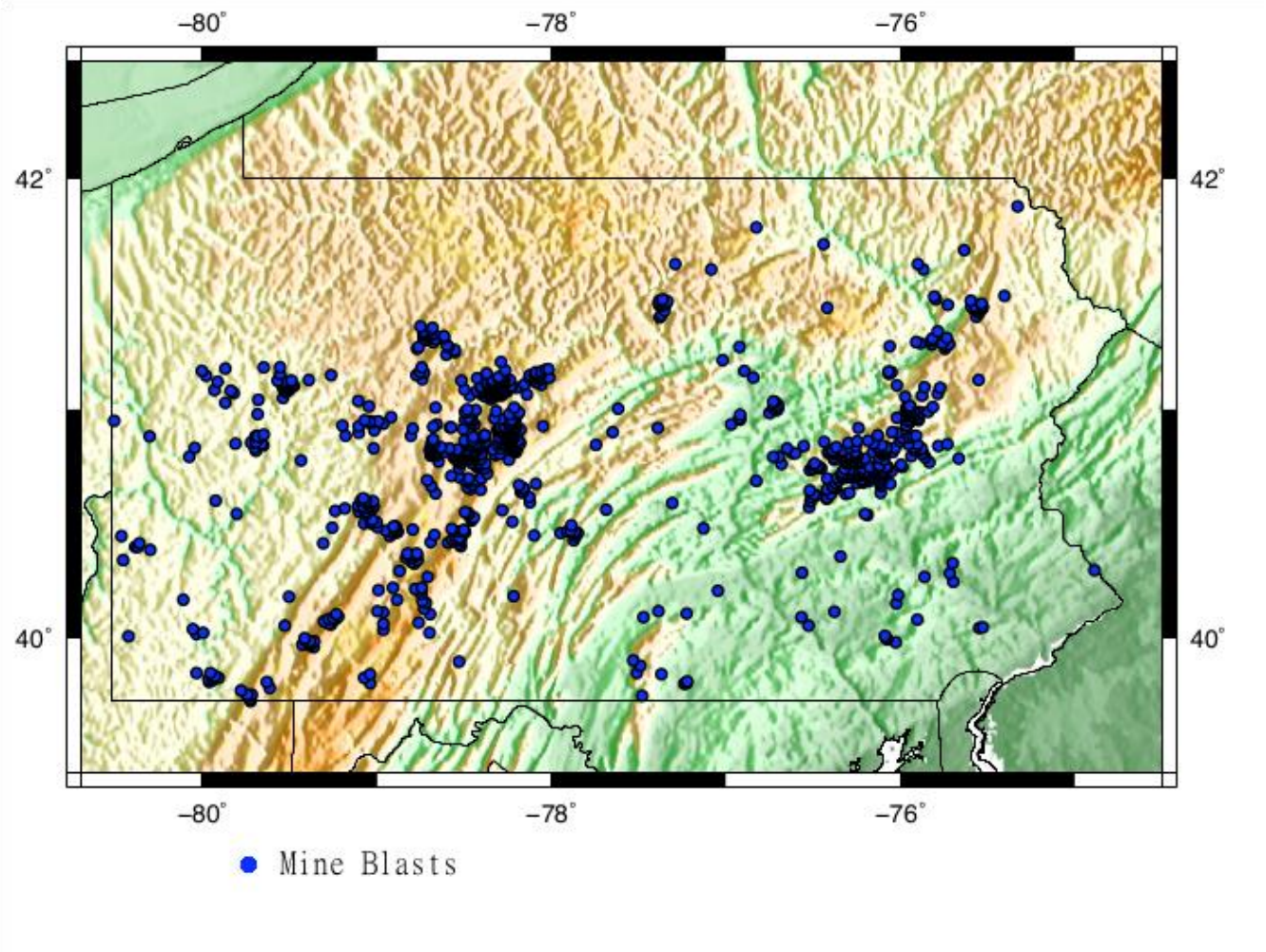


Figure 2.6: Seismic events classified as mine/quarry blasts from the PASEIS catalog.

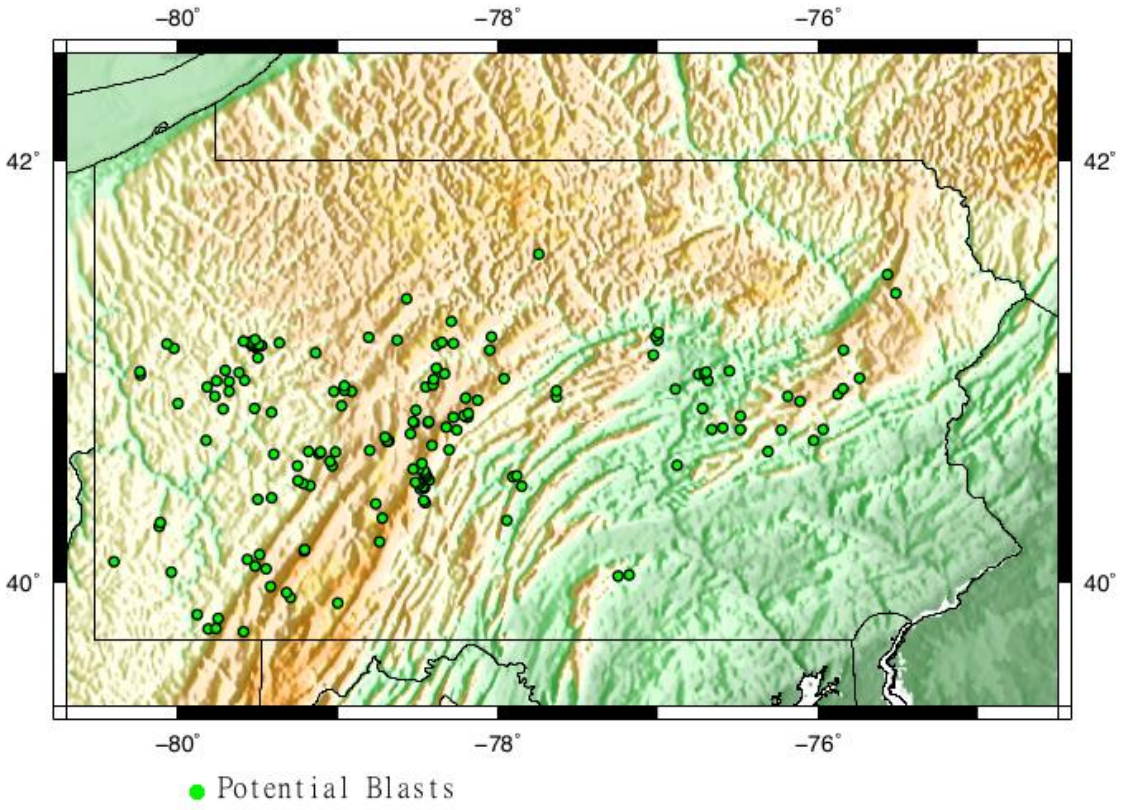


Figure 2.7: Events classified as potential blasts from the PASEIS catalog.

In addition, sixty-four events that occurred northwest of Williamsport have been classified separately (Figure 2.8). These events occurred in a cluster pattern and were easy to distinguish from the rest of the catalog due to their location and the small number of nearby events. These events were classified separately as many of them were difficult to distinguish based on waveform characteristics, even though a coal mine is located near the cluster. Further work to classify these events is presented in Chapter 3.

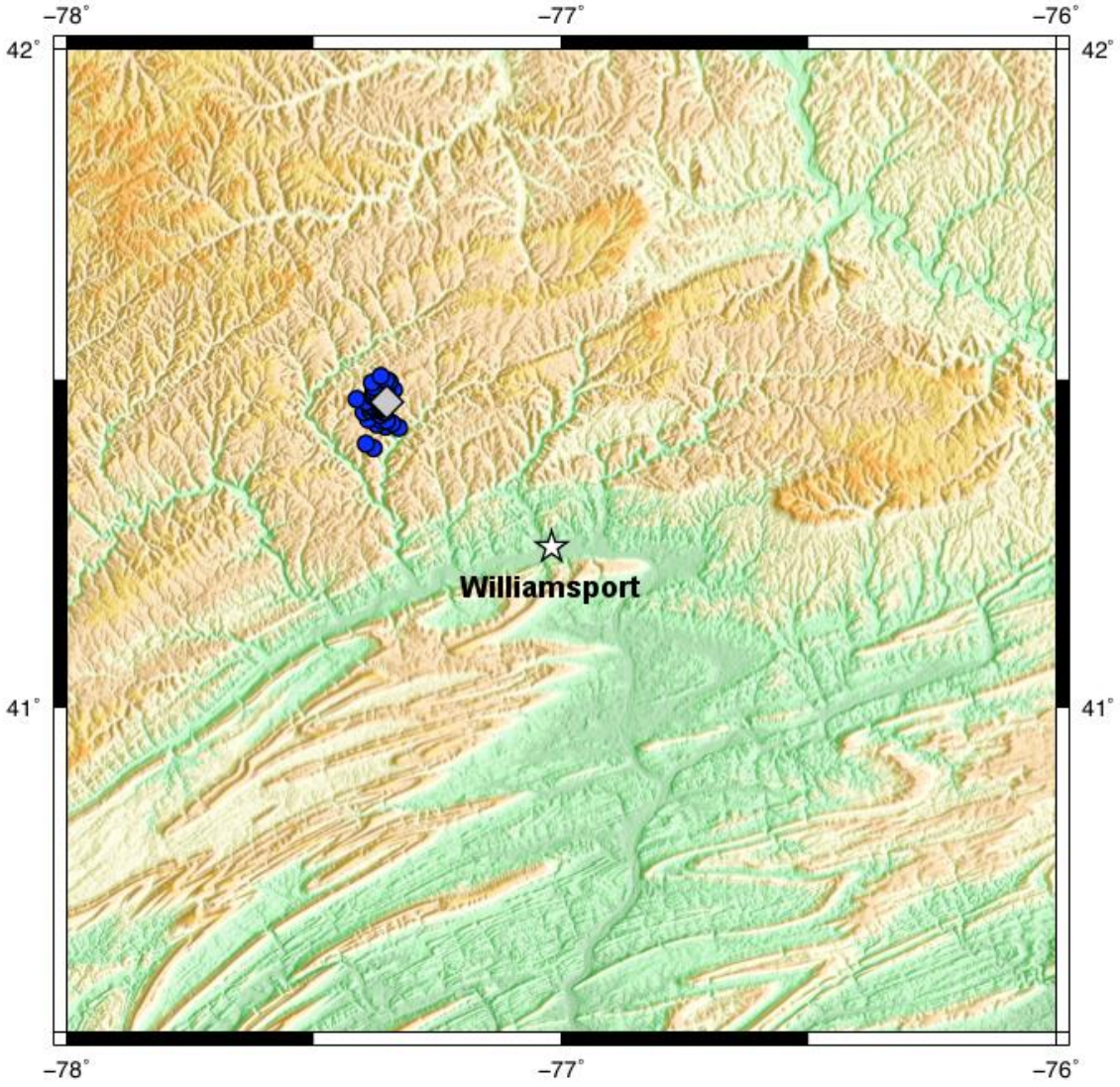


Figure 2.8: Locations of seismic events identified as part of the Williamsport cluster. Events are depicted as blue circles and the location of a nearby coal mine is shown as a gray diamond.

Non-Mining Events

Eleven events in the catalog appear not to be associated with mining/quarry activity. Four of these events are listed in the USGS earthquake catalog and seven events are only in the PASEIS catalog (Table 2.1). Magnitudes (M_L) range from 1.31 to 2.29 with an average magnitude of 1.83. The average RMS obtained from the event locations is 0.6 seconds and the two average horizontal error ellipse axes are 0.3 km and 0.4 km. Depths of the 11 events are well constrained except for one event. For the well-constrained events, the average depth is 5.0 km with a vertical error ellipse axis of 0.6 km.

Table 2.1: Non-Mining events from February 2013-December 2014

YYYYMMDD	HHMM	Sec	Lat (Deg)	Long (Deg)	Depth (km)	Mag (M_L)	N	D1 (km)	Gap (deg)	RMS (s)	SEH (km)	SEH (km)	SEZ (km)
20130219	0953	3.24	41.26	-77.07	10.6	2.3	16	85	99	0.35	0.2	0.4	0.5
20130703	0054	24.54	40.22	-79.32	1.1	1.7	25	2	53	0.79	0.2	0.2	0.4
20130703	0056	16.28	40.24	-79.34	0.1	1.7	24	5	52	0.66	0.2	0.2	0.5
20130716	0358	9.51	39.86	-77.59	0.0	1.9	34	31	62	0.54	0.2	0.2	0.4
20130718	0451	49.32	39.86	-77.59	0.0	1.7	16	31	43	0.63	0.2	0.3	0.7
20130824	0507	26.89	40.15	-80.34	0.1	2.2	37	5	38	0.84	0.2	0.2	0.4
20140109	0202	38.26	39.91	-76.30	5.8	1.5	7	15	129	0.24	0.4	0.4	1.2
20140209	2234	4.23	41.47	-80.37	4.3	2.0	20	19	94	0.23	0.2	0.3	0.4
20140305	0618	9.08	39.98	-80.46	0.0	1.9	12	11	82	0.35	0.3	0.4	0.8
20140729	2012	7.27	40.44	-78.10	27.8	2.0	7	44	189	0.94	0.5	0.9	0.6
20140905	2000	10.85	40.26	-76.52	0.0	1.3	5	27	168	0.23	0.3	0.7	99.0

Relocation of Non-Mining Events

To obtain improved locations for the non-mining events through event relocation, P-wave arrival picks were reviewed and S-wave arrivals were picked using 1-10 Hz bandpass filtered data. P-waves were picked on the vertical channels while S-waves were picked on one of the horizontal channels. Table 2.2 and Figure 2.9 shows the event relocations. It should be noted that in using the 1-10 Hz bandpass filter, several smaller events were observed in the waveforms, however, arrivals were not observed on enough stations to obtain locations.

Table 2.2: Relocated Events from Table 1

YYYYMMDD	HHMM	Sec	Lat (Deg)	Long (Deg)	Depth (km):	Mag (M_L)	N	D1 (km)	Gap (Deg)	RMS (s)	SEH (km)	SEH (km)	SEZ (km)
20130219	0953	3.17	41.27	-77.08	9.3	2.3	15	85	116	0.39	0.2	0.4	0.9
20130703	0054	24.26	40.24	-79.33	1.4	1.6	21	5	52	0.60	0.2	0.2	0.5
20130703	0056	16.2	40.23	-79.32	0.1	1.7	22	3	53	0.64	0.2	0.2	0.6
20130716	0358	9.25	39.84	-77.60	0.0	1.9	32	33	52	0.40	0.2	0.2	0.4
20130718	0451	49.29	39.87	-77.60	0.0	1.3	16	31	44	0.40	0.2	0.3	0.7
20130824	0507	26.55	40.15	-80.36	0.0	2.2	34	4	52	0.73	0.2	0.2	0.4
20140109	0202	38.4	39.91	-76.31	0.1	1.5	11	16	97	0.26	0.2	0.3	13.7
20140209	2234	4.18	41.48	-80.37	5.5	2.0	20	19	95	0.26	0.2	0.3	0.4
20140305	0618	8.87	39.98	-80.49	0.0	1.9	15	11	88	0.51	0.3	0.3	0.7
20140729	2012	5.76	40.45	-77.88	0.8	2.0	7	34	108	0.27	0.4	0.4	1.0
20140905	2000	0	40.27	-76.53	8.7	1.3	6	26	162	0.12	0.4	0.7	1.1

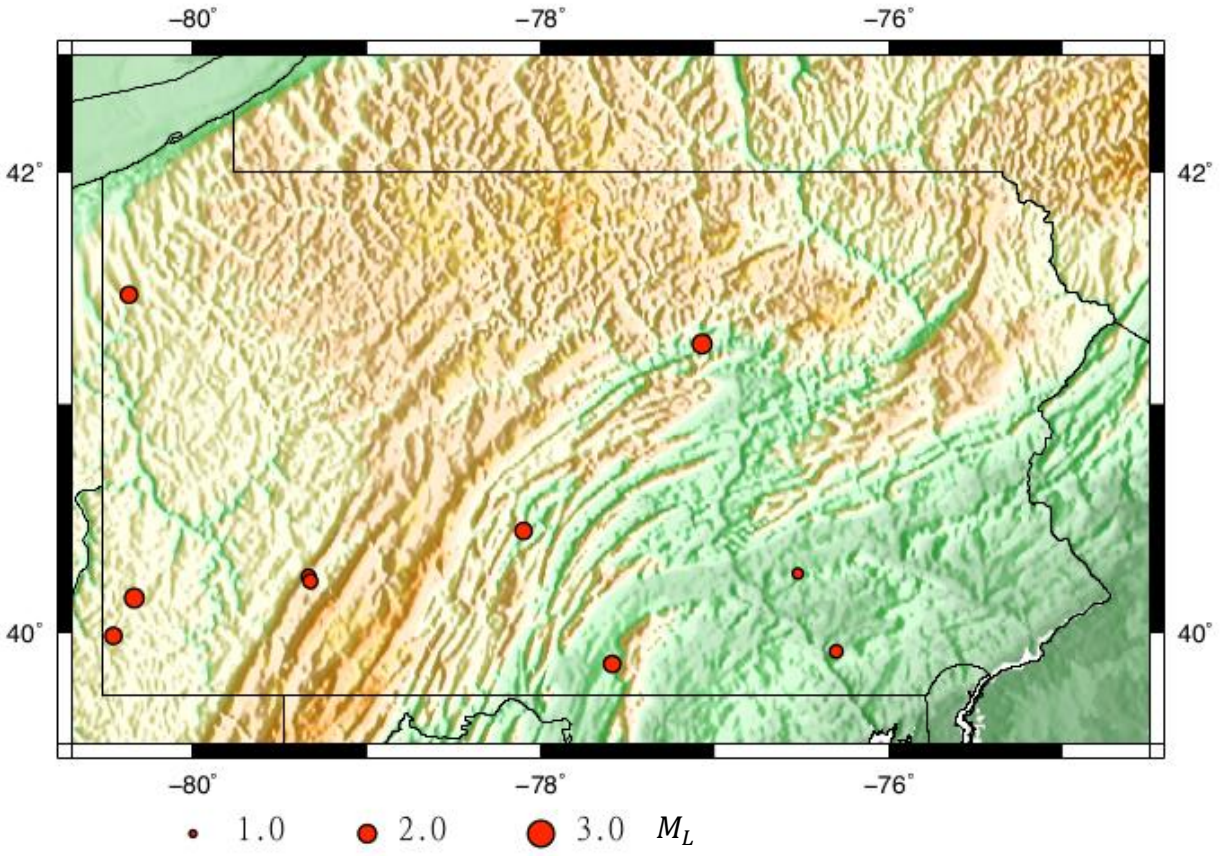


Figure 2.9: Non-mining related events in the PASEIS catalog.

Examining Possible Correlation with Natural Gas Production

Location data for unconventional natural gas wells in the Commonwealth for 2013 and 2014 were obtained from fracfocus.org. Fracfocus is the national hydraulic fracturing chemical registry. In Pennsylvania, Fracfocus is used as an official state chemical disclosure repository. It is used primarily for disclosure of

chemicals used during the hydraulic fracturing process by participating companies, however, the records also provide the latitude and longitude of well pads. These coordinates were used in order to determine if there is a visual spatial correlation between the non-mining seismic events and gas production activity. The spatial correlation between well sites and seismic events was first examined (Figure 2.10). If the distance from the event to the well head was less than 5 km, then a temporal correlation was looked for between the event and hydraulic fracturing of the well using the start and end times of hydraulic stimulation, as most induced seismicity begins during the stimulation ceases shortly after (Holland, 2013; Skoumal et al., 2015).

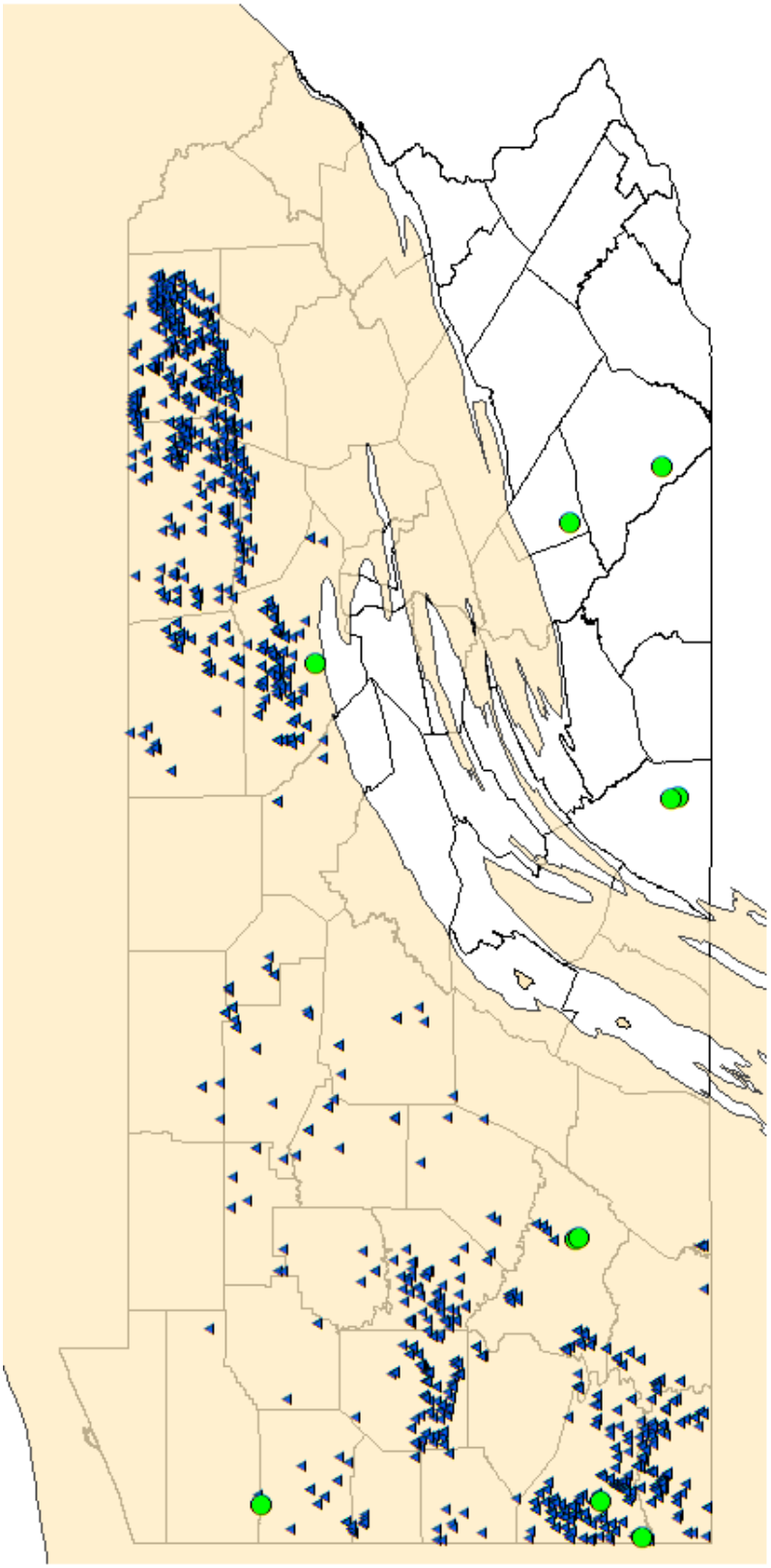


Figure 2.10: Unconventional wells that were stimulated in 2013/2014 (blue triangles). The map also shows non-mining events (green circles). Shaded region shows Marcellus Shale extent.

Using the fracfocus data, it was determined that 8 of the 11 non-mining events fall outside of the 5 km radius of a well head. For the remaining three events, two are located in Washington County and one is located in Mercer County. The Mercer County event occurred on February 29, 2014 at 22:34 UTC time. The nearest well, Byler 2083 4HD, is located 3.24 km east northeast from the event. The well began stimulation on April 10, 2013 and competed stimulation on April 18, 2013. Because well stimulation occurred well before the event, this event is probably not associated with natural gas production.

The first Washington County event occurred on August 24, 2013 at 05:07 UTC time. This event is located 2.47 km away from the Hanes, Donald et al Unit of well heads. The two stimulation phases that are closest in time to the event are Hanes, Donald et al Unit 7H and Hanes, Donald et al Unit 3H. 7H began stimulation on April 25, 2013 and was completed May 3, 2013 and 3H began stimulation on April 25, 2013 and was completed on May 4, 2013. The event occurred several months after the fracking process was completed, which is not what is typically seen in most fracking sites (Holland, 2013; Skoumal et al., 2015). Therefore, this event is also probably not associated with natural gas production.

The second Washington County event occurred on March 5, 2014 at 06:18 UTC. This event is located 2.62 km from the WFN6 A well, which was stimulated on January 21, 2014 and completed on February 4, 2014 and the WFN6 H well, which was stimulated February 2, 2014 and completed on February 12, 2014. This event occurred nearly a month after stimulation was completed, and therefore it too is probably not associated with natural gas production.

Discussion

The eleven non-mining events do not appear to be related to natural gas production and are therefore likely tectonic earthquakes. Figure 2.11 shows the non-mining event locations and mapped faults of Pennsylvania. Four events occur along the Ramapo fault system, Pennsylvania's most seismically active region. One event occurred in the Ridge and Valley province outside of the Ramapo area, and one event occurred in the Pymatuming region, the location of Pennsylvania largest earthquake (Maceira et al., 2000). Two events are located in Washington County. These events occur in an area where there has been no recorded seismicity. Initially, these two events were thought to be possibly related to natural gas production, however, the timing of the events and the stimulation of nearby wells is inconsistent with the literature on induced seismicity. Given the small size of the events, it is possible this area contains a small amount of natural seismicity that has gone unnoticed due to limited station coverage.

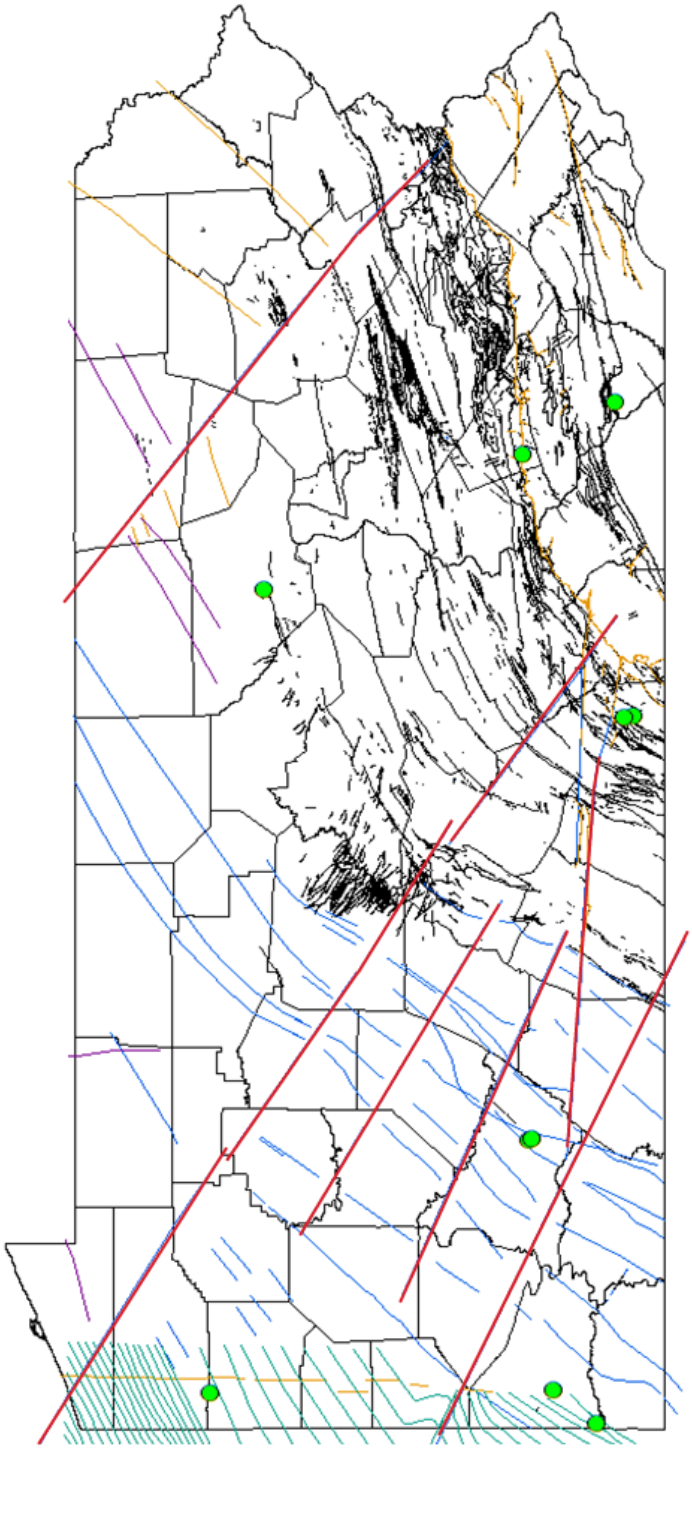


Figure 2.11: Compiled faults and lineaments from the Alexander et al. (2005) data set shown with non-mining seismic events

Induced seismicity linked to natural gas production has been a concern in recent years. Wastewater injection is primarily responsible for the induced seismicity associated with oil and gas exploration and production activity (Kim, 2013; Ellsworth, 2013; Keranan et al., 2014). Hydraulic fracturing, by its nature, produces small magnitude events. These events are expected to have magnitudes less than 1.0 and contain b-values around 2.0 (Warpinski et al., 2012; Maxwell et al., 2009; Skoumal et al., 2015). However, the hydraulic fracking process has also been linked to induced seismicity (Skoumal et al., 2015; Holland, 2013; Friberg et al., 2014), and there have been earthquakes with M_L 3.0 or less reported in the United States (Skoumal et al., 2015). For example, the M_L 3.0 event that occurred in Mahoning County, Ohio was part of a series of 5 earthquakes ranging from M_L 2.1 to 3.0 (Skoumal et al., 2015). In Harrison County, Ohio, Friberg et al. (2014) initially showed a series of 10 events ranging from Mw 1.7 to 2.2 linked to hydraulic fracturing. Cross correlation techniques were used to show many additional smaller magnitude events in the area, which provided further evidence that these events were related to natural gas production. In these cases, the induced seismicity is thought to be caused by slip along nearby faults, some of which penetrate into basement rock.

There is little evidence, if any, in the PASEIS catalog for fracking-related seismicity. If the catalog does contain such events, then they are no larger than the mining-related events occurring on a regular basis throughout the Commonwealth.

Conclusions

The PASEIS seismicity catalog mostly contains mining related events. 94.5% (1252 total) of events in the catalog are characterized as either blasts or potential blasts. In addition, 4.7% (64) are included in the Williamsport, PA cluster and will be further analyzed in Chapter 3. For the 0.8 % events (11) in the catalog that are determined to be non-mining events, there is little evidence, based on location and timing, for these events to be related to natural gas production. Although the majority of non-mining events occur in areas where there have been historical earthquakes, the two Washington County events are not in an area of known seismicity and could be indicative of an unknown seismic zone.

The mining-related events have similar magnitudes to earthquakes induced by hydraulic fracturing in nearby states. In addition, much of the natural gas production in the Commonwealth overlaps spatially with the bituminous coal fields. The similar magnitudes between the mining-related events in the PASEIS catalog and the induced seismicity in neighboring states from fracking and wastewater disposal, and the significant amount of mining-related seismicity create challenges for monitoring seismicity in Pennsylvania, particularly if well pads are in close proximity to mines. The amount of mining-related seismicity also creates challenges for detecting and locating small tectonic events in possibly unknown areas of seismicity. These challenges could be partially overcome if an accurate database of mine blasting locations and times was available and updated on a daily basis.

Chapter 3

Cross Correlation Template Event Matching: The Williamsport Event Cluster

Introduction

As described in Chapter 2, during the event classification stage of analyzing the catalog, a cluster of events northwest of Williamsport, PA was identified (see Figure 2.6). Given the timing of the events and the short distance to a nearby coal mine, it was suspected that the cluster of events could be the result of mining activity in the area. However, waveform characteristics for these waveforms were different from other blasting events across the Commonwealth, and these events were also recorded at larger distances than other events of similar magnitude. While the average number of stations used for event location in the catalog was 10, the events in this cluster were well recorded on an average of 32 stations. For this reason, a template matching cross correlation technique was used in obtaining relative locations, which can be used to better classify the events.

Event cluster and analysis

The Williamsport event cluster occurred roughly 39 km northwest of Williamsport. During event classification, 64 events whose waveforms were unlike other mining events (Figure 3.1) were identified. In addition, another 10 events that occurred in the cluster area could be classified as blasting events based on waveform characteristics, bringing the total number of events in the cluster to 74. Table 3.1 gives the event locations that are part of the Williamsport cluster.

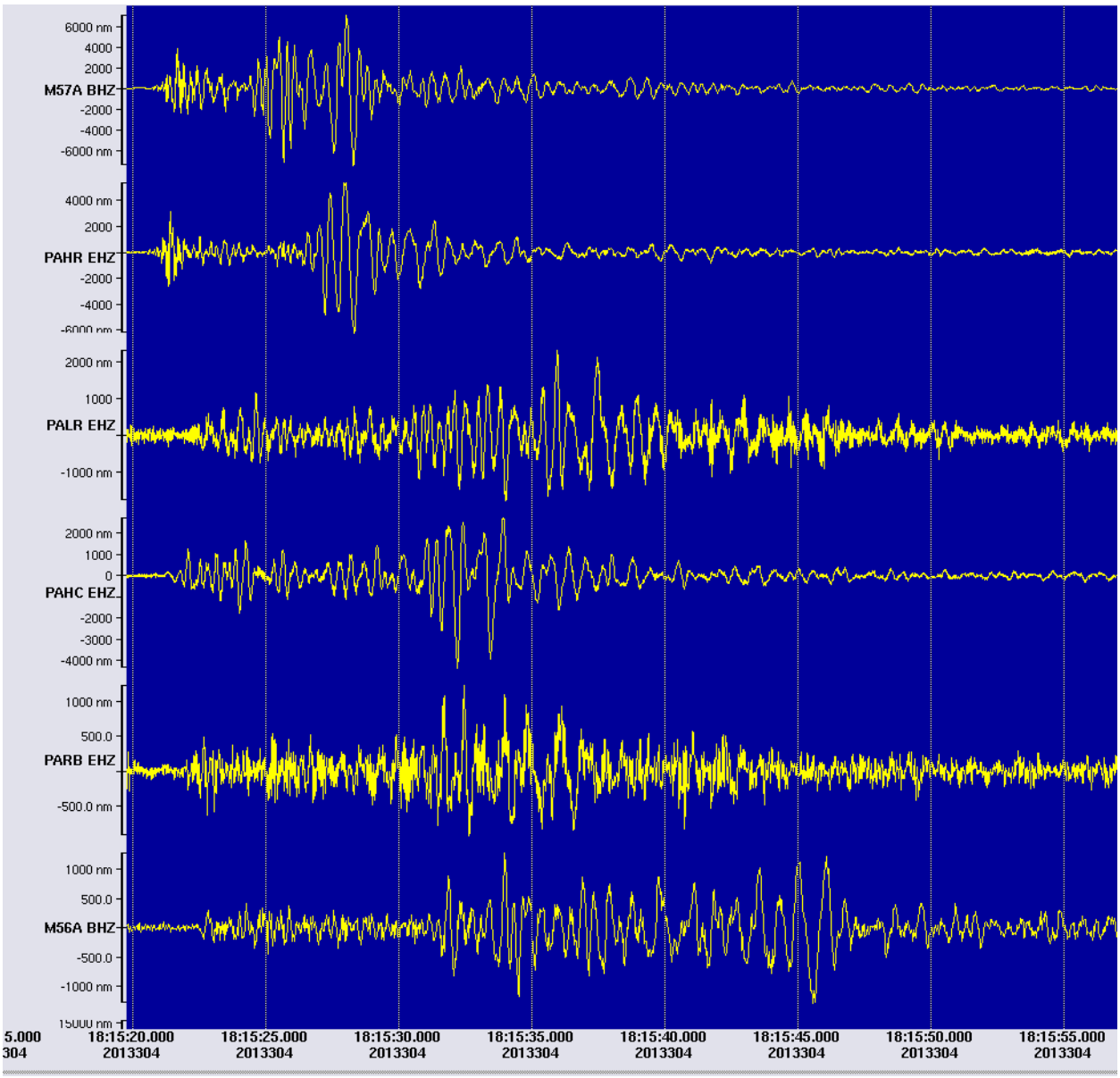


Figure 3.1: October 31, 2013 magnitude 2.45 event from the Williamsport cluster. Velocity seismograms are from the six nearest stations.

Table 3.1: Events in the Williamsport cluster

YYYYMMDD	HHMM	Sec	Lat (Deg)	Lon (Deg)	Depth (km)	Mag (M_L)	N	D1 (km)	Gap (Deg)	RMS (s):	SEH (km)	SEH (km)	SEZ (km)
20130220	2217	37.03	41.47	-77.37	0.3	2.5	21	86	108	0.73	0.2	0.3	0.5
20130327	1930	4.34	41.47	-77.36	3.0	2.5	19	26	94	0.69	0.3	0.3	0.5
20130328	1959	34.16	41.47	-77.36	0.1	2.5	19	25	70	0.67	0.2	0.3	0.5
20130417	1849	37.55	41.49	-77.38	3.6	2.2	16	25	61	0.34	0.2	0.3	0.5
20130423	1835	13.8	41.48	-77.37	0.0	2.3	24	25	63	0.51	0.2	0.2	0.5
20130502	2020	55.85	41.48	-77.38	0.0	2.5	39	25	46	0.62	0.1	0.2	0.4
20130503	1835	21.68	41.47	-77.35	0.0	2.7	45	27	42	0.70	0.1	0.2	0.4
20130506	1711	11.37	41.46	-77.37	0.0	2.3	24	24	69	0.56	0.2	0.3	0.5
20130529	1837	31.69	41.49	-77.38	0.0	2.2	23	41	108	0.81	0.2	0.3	0.5
20130530	1746	4.02	41.51	-77.36	0.6	2.4	35	41	110	0.74	0.2	0.2	0.4
20130604	1745	50.42	41.48	-77.35	0.0	2.6	43	44	77	0.75	0.1	0.2	0.4
20130606	1601	25.45	41.46	-77.37	0.0	2.2	28	44	76	0.85	0.2	0.3	0.5
20130620	1900	12.07	41.48	-77.35	0.1	2.6	42	44	77	0.72	0.1	0.2	0.4
20130813	2016	38.47	41.50	-77.35	0.0	2.8	53	28	78	0.74	0.1	0.2	0.3
20130827	1910	27.28	41.50	-77.35	0.1	2.7	56	28	29	0.78	0.1	0.2	0.3
20130829	1523	12.78	41.49	-77.36	0.0	2.4	41	27	37	0.66	0.2	0.2	0.4
20130903	1853	12.66	41.45	-77.37	0.5	2.3	33	24	48	0.57	0.2	0.2	0.4
20130906	1936	1.97	41.49	-77.36	0.0	2.7	66	26	25	0.71	0.1	0.1	0.3
20130910	1919	34.38	41.47	-77.37	0.0	2.5	54	25	22	0.74	0.1	0.2	0.3
20130911	1756	22.36	41.46	-77.37	0.1	2.0	29	24	35	0.71	0.2	0.2	0.5
20130913	1850	16.37	41.48	-77.36	0.0	2.6	58	26	28	0.63	0.1	0.1	0.3
20130916	1853	13.7	41.46	-77.38	0.1	2.5	51	23	30	0.85	0.1	0.2	0.3
20130917	2109	47.05	41.46	-77.36	0.0	2.4	28	25	69	0.74	0.2	0.2	0.4
20130918	2042	14.92	41.47	-77.36	0.1	2.3	54	26	19	0.60	0.1	0.1	0.3
20130920	1752	45.88	41.47	-77.38	0.1	2.5	59	24	29	0.84	0.1	0.1	0.3
20130925	2059	47.04	41.48	-77.37	0.0	2.9	75	25	21	0.83	0.1	0.1	0.3
20130927	1722	5.18	41.47	-77.35	0.0	2.8	70	27	19	0.68	0.1	0.1	0.3

20131001	1821	46.75	41.47	-77.38	0.0	2.3	48	25	29	0.67	0.1	0.2	0.3
20131003	1911	57.69	41.48	-77.38	0.1	2.7	59	25	22	0.68	0.1	0.1	0.3
20131004	1718	44.45	41.47	-77.37	0.0	2.2	42	25	39	0.67	0.1	0.2	0.4
20131031	1815	21.98	41.45	-77.39	0.0	2.5	42	23	30	0.76	0.1	0.2	0.4
20131106	1820	49.5	41.46	-77.37	0.0	2.5	50	25	29	0.69	0.1	0.2	0.3
20131108	1911	29.73	41.46	-77.36	0.1	2.7	65	25	19	0.81	0.1	0.1	0.3
20131112	1937	17.94	41.47	-77.35	0.0	2.8	61	26	19	0.65	0.1	0.1	0.3
20131119	1645	25.73	41.47	-77.36	0.0	2.6	62	25	19	0.78	0.1	0.1	0.3
20131121	1648	19.34	41.47	-77.36	0.1	2.4	55	26	28	0.70	0.1	0.1	0.3
20131125	1933	54.72	41.45	-77.37	0.0	2.4	45	24	29	0.74	0.1	0.2	0.4
20140116	1708	11.45	41.44	-77.35	0.0	1.8	10	25	144	0.68	0.3	0.4	0.7
20140117	2022	41.89	41.46	-77.36	0.0	2.6	44	25	29	0.53	0.1	0.2	0.3
20140120	2032	2.19	41.47	-77.37	0.0	2.6	56	25	26	0.72	0.1	0.1	0.3
20140124	1917	0.37	41.46	-77.36	0.0	2.4	45	25	36	0.55	0.1	0.2	0.3
20140127	1826	2.53	41.46	-77.37	0.0	2.4	27	25	38	0.51	0.2	0.2	0.5
20140131	2014	11.49	41.46	-77.36	2.5	2.5	15	25	133	0.49	0.2	0.4	0.6
20140203	1820	1.42	41.49	-77.37	0.1	2.6	48	42	26	0.58	0.1	0.2	0.3
20140204	1735	15.06	41.48	-77.37	1.8	2.1	36	25	28	0.56	0.2	0.2	0.4
20140206	1847	36.62	41.46	-77.36	0.0	2.3	41	25	28	0.47	0.1	0.2	0.4
20140314	1638	20.85	41.46	-77.38	0.1	2.5	30	31	36	0.55	0.2	0.2	0.4
20140318	1530	31.8	41.45	-77.36	0.1	2.5	33	30	45	0.59	0.2	0.2	0.4
20140321	1759	6.46	41.44	-77.39	0.1	2.2	44	22	34	0.72	0.1	0.2	0.3
20140324	1753	51.98	41.45	-77.38	0.0	1.9	12	23	81	0.64	0.3	0.3	0.9
20140414	1854	53.22	41.45	-77.36	0.1	2.3	16	24	57	0.51	0.2	0.3	0.5
20140424	1739	37.29	41.45	-77.37	0.0	2.5	27	24	49	0.54	0.2	0.2	0.4
20140502	1731	27.05	41.46	-77.35	0.0	2.3	9	29	158	0.45	0.3	1.1	0.8
20140610	1752	17.85	41.47	-77.33	0.0	2.4	6	28	175	0.49	0.4	1.6	1.1
20140617	1543	31.64	41.48	-77.35	0.1	2.4	23	27	49	0.46	0.2	0.2	0.5
20140701	1748	22.13	41.46	-77.39	2.0	2.6	17	32	81	0.67	0.2	0.2	0.9
20140702	1902	40.71	41.47	-77.41	0.1	2.4	14	64	67	0.52	0.3	0.3	0.6

20140709	1911	47.07	41.46	-77.37	0.0	2.4	38	24	40	0.76	0.2	0.2	0.4
20140711	1409	49.33	41.47	-77.39	0.0	2.4	30	23	40	0.68	0.2	0.2	0.4
20140717	1728	56.92	41.40	-77.38	0.0	2.3	25	21	172	1.38	0.2	0.3	0.4
20140730	1905	53.65	41.43	-77.35	0.0	2.5	13	29	155	0.63	0.2	0.5	0.6
20140924	1734	46.63	41.48	-77.36	0.0	2.3	10	31	159	0.62	0.3	0.5	0.9
20140929	1852	57.94	41.41	-77.37	0.9	2.3	9	30	162	0.45	0.2	1.3	0.6
20141003	1950	1.05	41.45	-77.40	19.9	2.7	14	33	60	0.89	0.2	0.3	0.5
20141007	1846	32.89	41.47	-77.38	0.9	2.1	12	32	61	0.38	0.2	0.3	2.1
20141009	1908	5.56	41.46	-77.38	0.0	2.2	14	31	82	0.52	0.2	0.3	1.3
20141013	1855	15.68	41.48	-77.35	2.0	2.2	12	31	79	0.39	0.3	0.3	1.3
20141014	1947	48.61	41.43	-77.33	0.0	2.1	11	26	63	0.43	0.3	0.3	2.2
20141017	1745	10.74	41.40	-77.39	0.0	2.0	11	32	88	0.62	0.3	0.3	99.0
20141121	2011	10.16	41.45	-77.37	1.8	2.2	13	30	83	0.85	0.3	0.3	0.8
20141125	1627	2.43	41.43	-77.34	0.0	2.1	12	28	62	0.48	0.2	0.3	99.0
20141126	1345	54.88	41.43	-77.37	1.2	2.0	11	30	84	0.58	0.3	0.4	0.9
20141211	1858	26.81	41.48	-77.34	2.5	2.3	14	29	76	0.75	0.3	0.3	0.8
20141219	1648	33.15	41.44	-77.36	0.0	2.3	5	29	143	0.67	0.4	0.5	99.0

A template waveform for the cross correlation technique was chosen from this cluster. The September 25, 2013 magnitude 2.85 event was used for the template because it is one of the largest events and the waveforms have a high signal-to-noise ratio. Data used in the cross correlation came from a subset of stations that belong to the TA and the temporary PASEIS networks from April, 2013 to December, 2014. A list of stations used in the cross correlation is given in Table 3.2.

Table 3.2: Stations used in the cross correlation

Station Name	Latitude	Longitude	Network code
M56A	41.48	-78.18	TA
M57A	41.37	-77.02	TA
M58A	41.37	-76.46	TA
N56A	40.92	-78.30	TA
N58A	40.84	-76.72	TA
PAHC	41.80	-77.19	XY
PAHR	41.36	-77.63	XY
PALB	40.45	-77.19	XY
PALR	41.73	-77.76	XY
PARB	40.99	-77.20	XY

Using the template event and stations described above, a cross correlation technique (Gibbons and Ringdal, 2006; Zhang and Wen, 2014) was applied to the 3-channel continuous waveform data from April 2013 to December 2014. To compute the cross correlation, the data were bandpass filtered between 0.5 – 10 Hz, decimated to 20 samples per second, and a 20% cosine taper was applied. Cross correlograms were obtained for each station, and then a stacked cross correlogram was created from the station data.

Location of the cross correlation detected events was performed by utilizing a grid search (Zhang and Wen, 2014). The edge of the grid was set at 7 km from the template event with a grid spacing of 100 m. An assumed slowness of 0.29 s/km was used. Travel time corrections for each location were made and the maximized cross correlation value was computed. Events locations were determined using a cross correlation value threshold of 0.35. This was determined based on an average background noise value of 0.05. Figure 3.2 shows examples of stacked cross correlograms and Figures 3.3 and 3.4 show the corresponding waveforms.

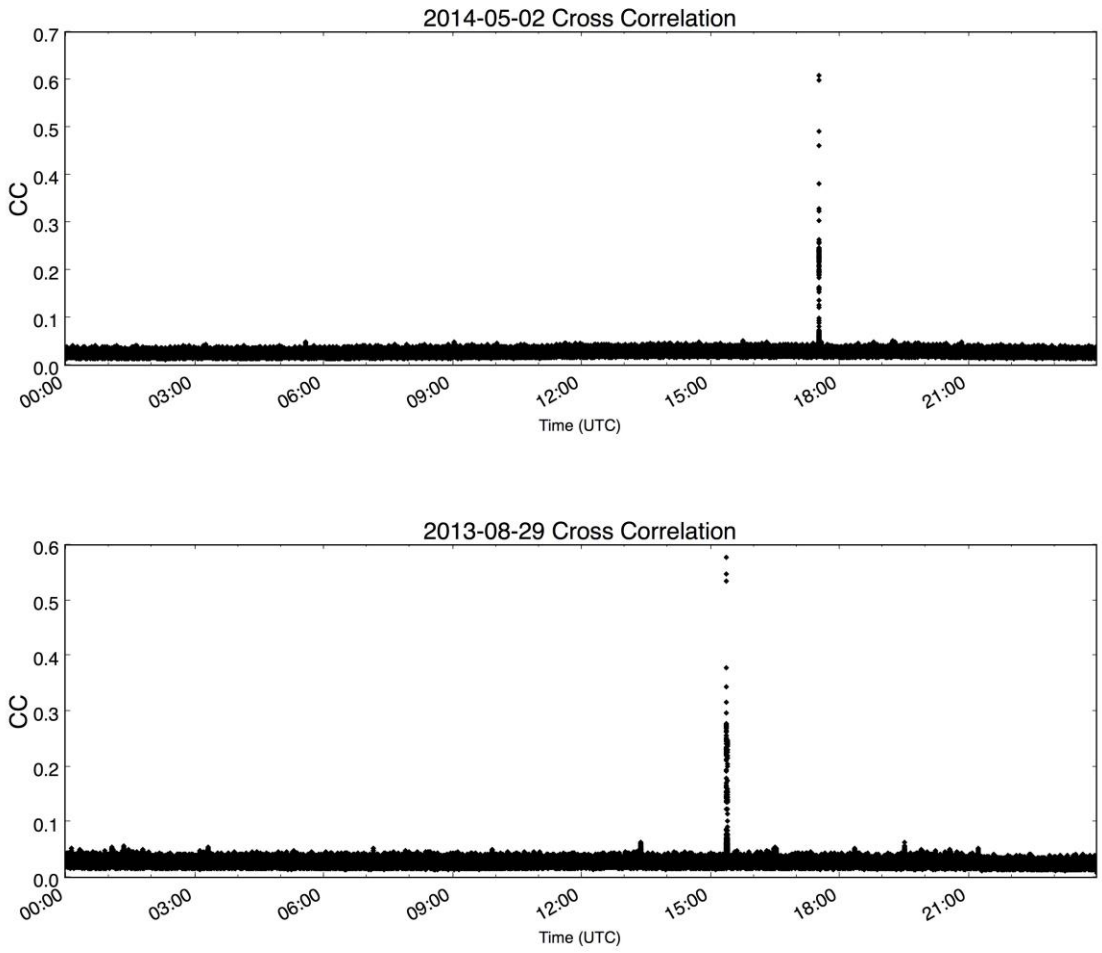


Figure 3.2: Example cross correlation events for two detections in the Williamsport cluster.

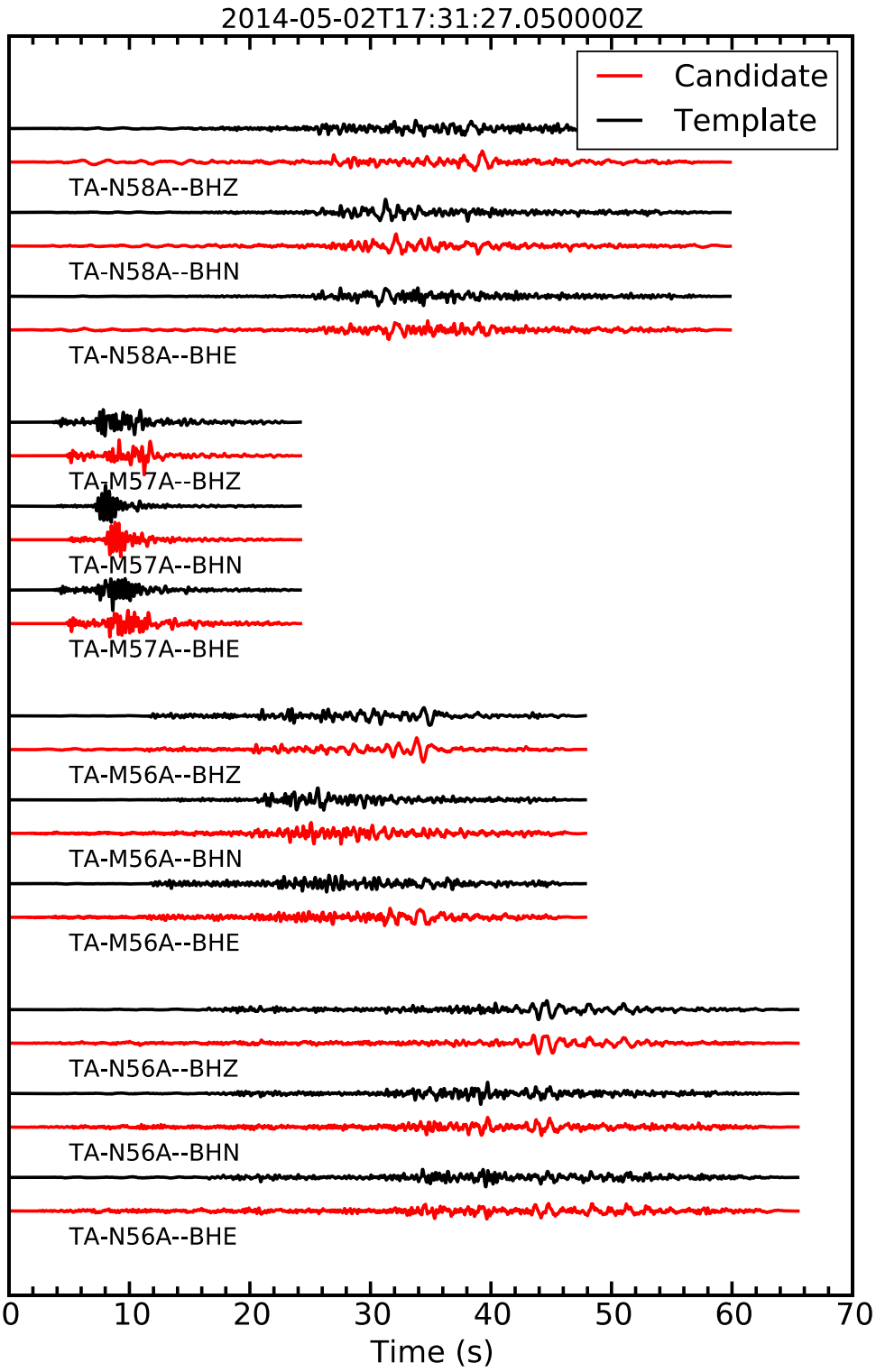


Figure 3.3: A subset of stations used in the cross correlation depicting candidate and template waveforms for the May 2, 2014 detection shown in Figure 3.2.

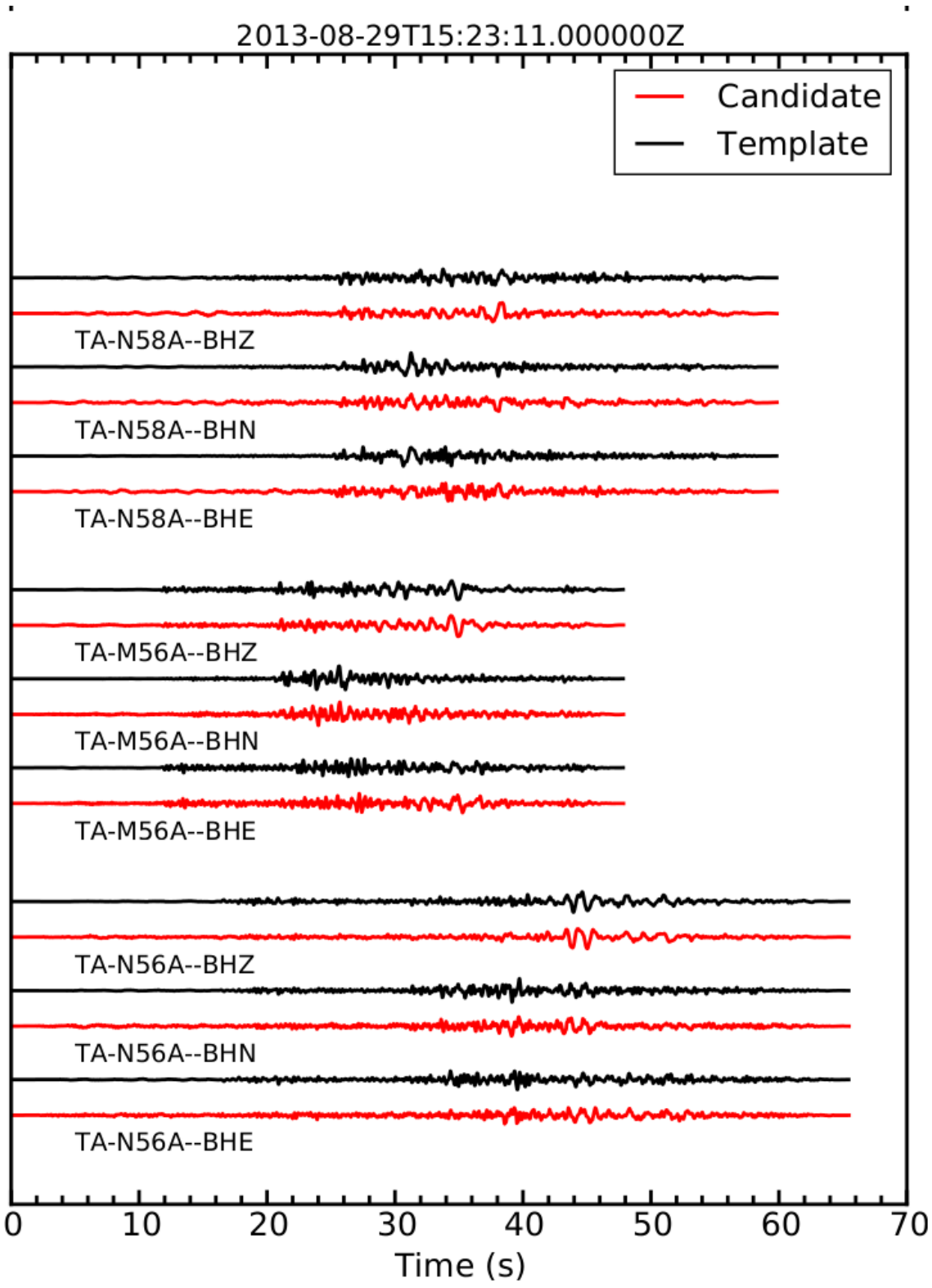


Figure 3.4: A subset of stations used in the cross correlation depicting candidate and template waveforms for the August 29, 2013 detection shown in Figure 3.2.

Template-Matched Events

Results from the cross correlation detection and location yielded 74 events that contain a cross correlation value of 0.35 or greater. These results are mostly consistent with the catalog of events that are classified as being a part of the cluster. However, 8 events in the catalog were not picked up by cross correlation and 11 events detected by the cross correlation are not in the catalog. The 8 catalog events have a cross correlation value less than 0.35, and this could indicate that these events result from a different source than the template event.

The relative event relocations are shown in Figure 3.5, together with the original locations. The event locations have a bias as the locations are established relative to the template event location. In order to get a better approximation of the absolute location, the centroid of the cluster is a taken as a suitable average location for the cluster. If the centroid of the cross-correlated event cluster is moved to the centroid of the original event cluster, absolute location closer to the Thomas coal mine is obtained (Figure 3.6). The location of the cluster to the coal mine using the relocated events is ~0.6 km, and ~1.0 km to the mine face. Based on satellite imagery, the northwest-southeast orientation of the event cluster is consistent with the orientation of the mine face and the total distance from the northwest to the southeast of the cluster is consistent with the length of the mine. Given the proximity of the cluster to the mine and that no events in the cluster occurred outside of the daytime hours, this cluster of events is likely a result of activity at the coal mine. The location of the cluster ~0.6 km from the mine could occur from

errors in P-wave travel time picks for the template event, the velocity model used for event location, or the azimuthal distribution of stations.

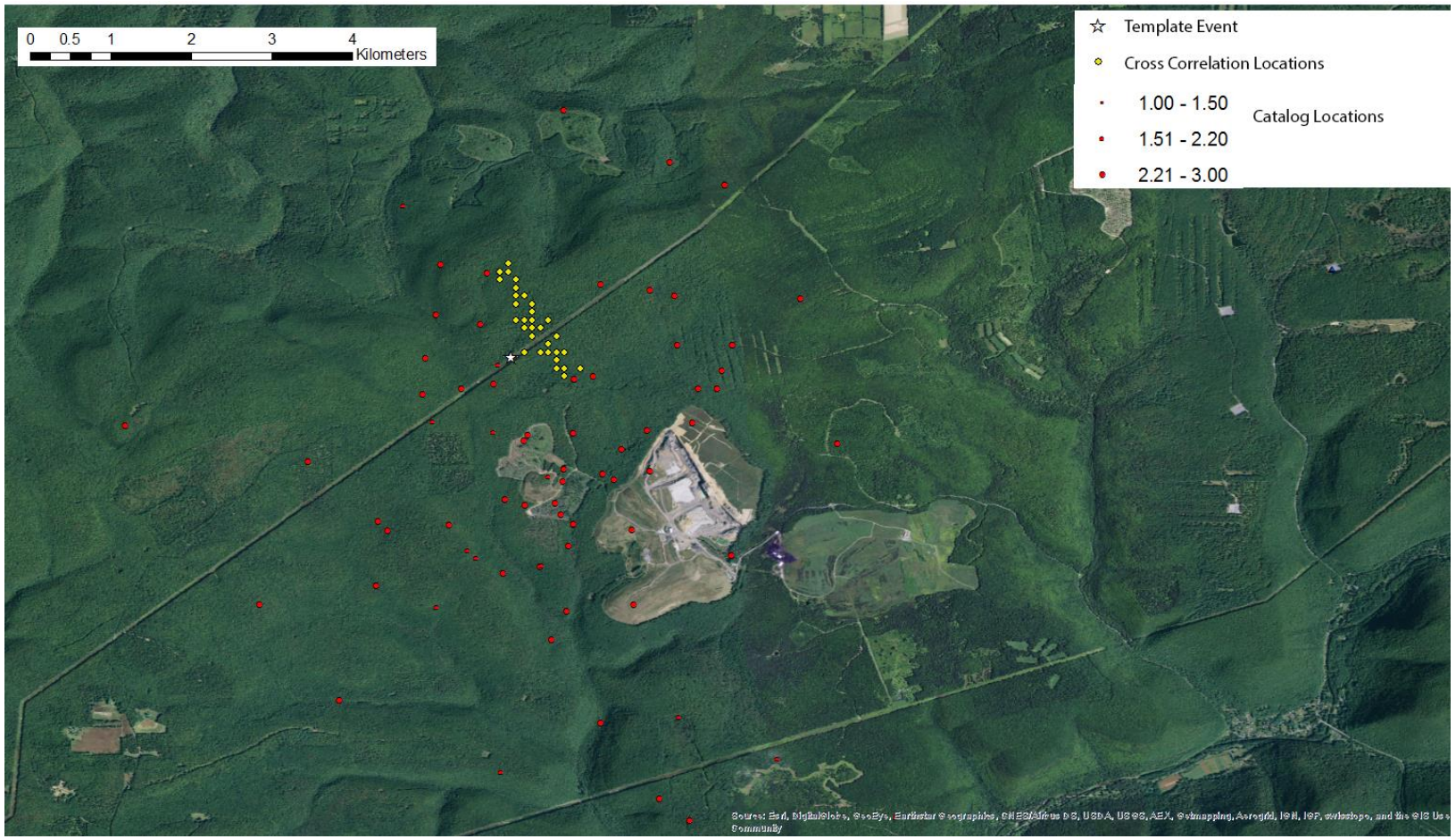


Figure 3.5: PASEIS seismic event locations, the cross correlation template event, and the cross correlation locations shown near the Thomas mine.

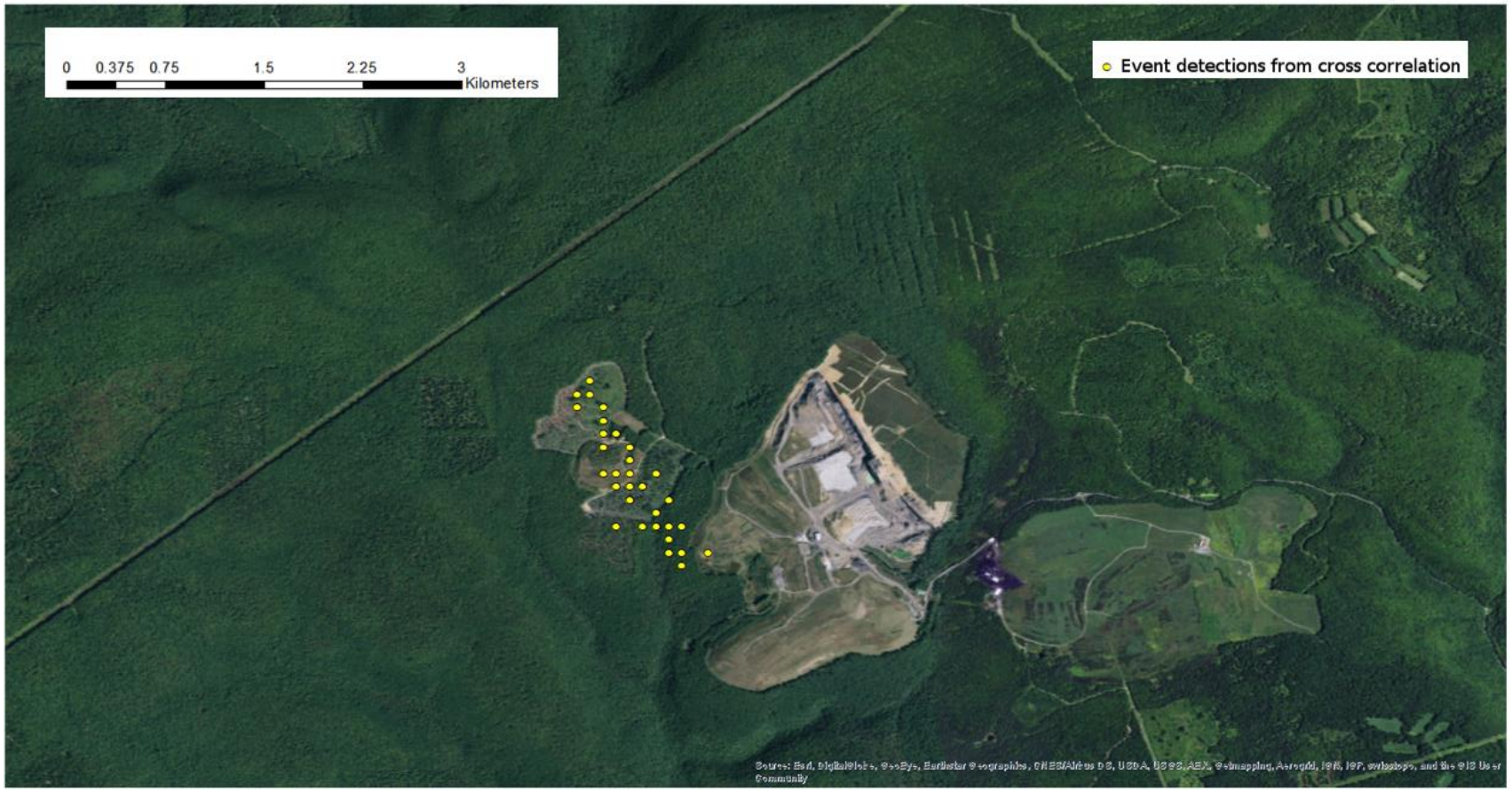


Figure 3.6: The cross correlation located events moved to the centroid of the PASEIS catalog event cluster.

Chapter 4

Summary and Conclusions

In this thesis, data from several seismic networks were used to develop a catalog of seismic events for Pennsylvania from February 2013 to December 2014 (PASEIS catalog, Appendix C). This was done by first building a database from continuous, three-component, broadband data. Using the Antelope Environmental Data Collection Software Suite, P-wave arrivals were picked using 1-5 Hz bandpass filtered vertical component seismograms. Initial hypocenters were determined using the IASP91 velocity model. Magnitudes were computed using Richter's (1935) method for determining local magnitude (M_L). The P-wave arrival times were subsequently used with the HYPOELLIPSE code (Lahr, 1989) and a velocity model developed for Pennsylvania to relocate the events. Most events occur between 12:00 and 22:00 UTC during week days. The catalog consists of 1355 events in Pennsylvania and is complete to a M_L of 2.0. The Gutenberg-Richter plot yielded a b-value of 2.63 for the catalog.

The b-value and occurrence of events primarily during working hours on week days suggest that most of the events may be the result of mining activity. To further investigate this possibility an event classification procedure was performed. Events were classified based on criteria used by the USGS for determining mining-related seismicity as well as criteria used by Lockridge et al. (2012) and Stump et al. (2002). The results of event classification showed that the PASEIS catalog predominantly contains mining-related seismicity. A cluster of events near

Williamsport was classified separately because the waveform characteristics were not diagnostic of mining-related seismicity or earthquakes.

Through the classification process, 11 of the 1355 events in the catalog were found to be unrelated to mining activity. P-wave and S-wave arrival times for these events were repicked using 1-10 Hz bandpass filtered data and relocated using the Pennsylvania velocity model and HYPOELLIPSE. Event locations and origin times were examined to determine if there was a spatial and temporal correlation with natural gas extraction activity. No correlation was found and therefore there is little, if any, evidence for seismic events in the PASEIS catalog caused by hydraulic fracturing or wastewater injection. Nine of these events occur in areas of previously recorded seismicity, with four occurring in the southeastern part of the state. The other two non-mining events occurred in Washington County, an area with no previously recorded seismic activity.

A cross correlation match and locate technique was applied to the Williamsport cluster using a template event that occurred on September 25, 2013. Upon locating the cross correlation detections relative to the template event, and then moving the locations to the centroid of the cluster, it was determined that the Williamsport cluster is a result of mining activity at the Thomas coal mine. The events occur during the daytime and the cross correlation locations show remarkable similarity to the azimuth and length of the mine face.

The findings of this study are important for future monitoring of seismicity in Pennsylvania. The natural gas region and the bituminous coal region in the Commonwealth overlap spatially. The similar magnitudes of induced earthquakes in nearby states and the mining-related events in Pennsylvania, as well as the amount of mining-related seismicity occurring daily across the Commonwealth, present challenges for monitoring seismicity of the state, particularly in areas where well pads are in close proximity to mine locations. Accurate event locations, magnitude estimates, and origin times are required to discriminate between mining events and possible seismicity induced by natural gas production, and to obtain that information, a large seismic network is required. The amount of mining-related seismicity generated from both coal and industrial mineral mines also creates challenges for detecting and locating small tectonic events in both known and possibly unknown areas of earthquake activity. These challenges could be partially overcome if an accurate database of mine blasting location and times was available and updated on a daily basis.

Bibliography

Alexander, S. S., Cakir, R., Doden, A. G., and others, compilers, 2005, "Basement depth and related geospatial database for Pennsylvania" *Pennsylvania Geological Survey, 4th ser., Open-File Report OFGG 05-01.0*, 1 map, scale 1:500,000. Available online.

Alexandrowicz, N. and R. Cole "Structure beneath the Appalachian Plateau of northwestern Pennsylvania and relationship to the 1998 Pymatuning earthquake", *Geological Society of America Abstracts with Programs* 31, No.2. (1999)

Armbruster, J.G. and L. Seeber. "The 23 April 1984 Martic Earthquake and the Lancaster Seismic Zone in Eastern Pennsylvania" *Bulletin of the Seismological Society of America* 77.3(1987) 877-890.

Astiz, L., J. Eakins, V.Martynov, T. Cox, J. Tytell, J.Reyes, R. Newman, G. Karasu, T. Mulder, M. White, G. Davis, R. Busby, K. Hafner, J. Meyer, and F. Vernon, "The Array Network Facility Seismic Bulletin: Products And an Unbiased View of United States Seismicity." *Seismological Research Letters* 85.3 (2014): 576–593.

Bent, A. L. "Source Parameters of the Damaging Cornwall-Massena Earthquake of 1944 from Regional Waveforms." *Bulletin of the Seismological Society of America* 86.2 (1996) 489-497

Bollinger, G.A. "Seismicity and Crustal Uplift in the Southeastern United States". *American Journal of Science*. 273.A (1973) 396-408

Bollinger, G.A., "Seismicity of the Southeastern United States" *Bulletin of the Seismological Society of America* 63.5(1973) 1785-1808.

Bollinger, G. A., and R. L. Wheeler. "The Giles County, Virginia, Seismic Zone." *Science* 219.4588 (1983): 1063–1065.

Bratt, S. R., T. C. Bache. "Locating events with a sparse network of regional arrays" *Bulletin of the Seismological Society of America*, 78 (1988), 780-798

Chinnery,M.A., and D. A. Rogers. "Earthquake Statistics in Southern New England" *Earthquake Notes* 44.3-4(1973). 89-103.

Ellsworth, W. L. "Injection-Induced Earthquakes." *Science* 341.6142 (2013): 1225942–1225942.

Frankel, A. "Mapping Seismic Hazard In the Central and Eastern United States." *Seismological Research*

Letters 66.4 (1995): 8–21.

Friberg, P.A., G. Besana-Ostman, and I. Dricker. "Characterization of an Earthquake Sequence Triggered by Hydraulic Fracturing in Harrison County, Ohio" *Seismological Research Letters Early Edition* 85.6 (2014) 1-13

Geiger, L., "Probability method for the determination of earthquakae epicenters from the arrival time only (translated from Geiger's 1910 German article)" *Bulletin of St. Louis University*, v.8(1) (1912),, 56-71

Gibbons, S.J. and F. Ringdal, "The detection of low magnitude seismic events using array-based waveform correlation" *Geophysical Journal International.* 165 (2006) 149-166

Holland, A. "Earthquakes Triggered by Hydraulic Fracturing in South-Central Oklahoma" *Bulletin of the Seismological Society of America* 103.3 (2013) 1784-1792

Jones, J., K. Charles, H. Delano, W. Kreiger, and J. Kreiger, "The Dillsburg, Pennsylvania 2008-2009 Earthquake Swarm" *Abstract, Northeastern Geological Society of America Conference*, 2010

Kennett, B. L. N., and E. R. Engdahl (1991). "Traveltimes for Global Earthquake Locations and Phase Identification" *Geophysical Journal International* 122, 429-465

Keranen, K.M., M. Weingarten, G. A. Abers, B. A. Bekings, and S. Ge, "Sharp Increase in Central Oklahoma Seismicity Since 2008 Induced by Massive Wastewater Injection" *Science* 345 (2014) 448-451

Kim, W. "The ML Scale in Eastern North America" *Buelletin of the Seismological Society of Americ* 88.4 (1998) 935-951

Kim, W. "Induced Seismicity Associated with Fluid Injection Into a Deep Well in Youngstown, Ohio" *Journal of Geophysical Research: Solid Earth* 118 (2013) 1-13

Lahr, J. "HYPOELLIPSE/version 2.0 (super*): A Computer Program for Determining Local Earthquake Hypocentral Parameters, Magnitude, and First Motion Pattern" *US Geological Survey, Open-File Report OF* 89-0116 (1989), 81

Lockridge, J. S., M. J. Fouch, and J. R. Arrowsmith. "Seismicity Within Arizona during the Deployment of the EarthScope USArray Transportable Array." *Bulletin of the Seismological Society of America* 102.4 (2012): 1850–1863.

Maceira, M., C. J. Ammon, and R. B. Herrmann. “Faulting Parameters Of the September 25, 1998 Pymatuning, Pennsylvania Earthquake.” *Seismological Research Letters* 71.6 (2000): 742–752.

Maxwell, S.C., M. Jones, R. Parker, S. Miong, S. Leaney, D. Dorval, D. D’Amico, J. Logel, E. Anderson, and K. Hammermaster. “Fault Activation During Hydraulic Fracturing” *SEG Technical Program Expanded Abstracts* (2009) 1552-1556

“News Archive - The Earth Institute - Columbia University.” *News Archive - The Earth Institute - Columbia University*. Web. 9 Aug. 2015. <http://www.earthinstitute.columbia.edu/news/2004/story04-30-04b.html>

Nikolaou, S., J. Go, C. Beyzaei, C. Moss, and P. Deming. “Geo-Seismic Design In the Eastern United States: State of Practice.” *Geotechnical Engineering State of the Art and Practice* (2012):

Page, R.A., P.H. Molnar, and J. Oliver. “Seismicity in the Vicinity of the Ramapo Fault, New Jersey-New York” *Bulletin of the Seismological Society of America*. 58.2 (1968) 681-687

Ratcliffe, Nicholas M. “The Ramapo Fault System In New York and Adjacent Northern New Jersey: A Case of Tectonic Heredity.” *Geol Soc America Bull Geological Society of America Bulletin* 82.1 (1971): 125.

Richter, C.F. “An Instrumental Earthquake Magnitude Scale.” *Bulletin of the Seismological Society of America* 25 (1935) 1-32.

Root, S.I., and D. M. Hoskins “Lat 40º Fault zone, Pennsylvania: A New Interpretation” *Geology v. 5 (1977) 719-723*

“Routine United States Mining Seismicity : Goal And Scope of the Catalog.” *Routine United States Mining Seismicity : Goal and Scope of the Catalog*. Web. 9 Aug. 2015. <http://earthquake.usgs.gov/earthquakes/eqarchives/mineblast/goals.php>

Seeber, L., J. G. Armbruster, W. Kim, and N. Barstow. “The 1994 Cacoosing Valley Earthquakes near Reading, Pennsylvania: A Shallow Rupture Triggered by Quarry Unloading.” *Journal of Geophysical Research* 103.B10 (1998): 24505.

Sevon, W. D., compiler, 2000, "Physiographic provinces of Pennsylvania", Pennsylvania Geological Survey of the Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Geological Survey, 4th ser., Map 13, scale 1:2,000,000.

Skoumal, R.J., M. R. Brudzinski, and B. S. Currie. “Earthquakes Induced by Hydraulic Fracturing in Poland Township, Ohio” *Bulletin of the Seismological Society of America* 105.1 (2015) 189-197

Stein, S. and Wysession, M “Earthquake Statistics” *An Introduction to Seismology, Earthquakes, and Earth Structure.* Malden, MA: Blackwell Pub., 2003. 275-275. Print.

USGS, “USGS Newsroom.” *USGS Release: Magnitude – 5.8 Earthquake Strikes National Capital Area (8/23/2011)* N.p., 23 Aug. 2011. Web. 14 Sept. 2015.

Warpinski, N.R., J. Du, and U. Zimmer. “Measurements of Hydraulic-Fracture-Induced Seismicity in Gas Shales” *SPE Hydraulic Fracture Technology Conference*, The Woodlands, Texas, 6-8 (2012) Soc. Pet. Eng. Abstract 151597

Wiemer, S. “Mapping And Removing Quarry Blast Events from Seismicity Catalogs.” *Bulletin of the Seismological Society of America* 90.2 (2000): 525–530.

Wiemer, S., and M. Wyss, “Minimum magnitude of complete reporting in Earthquake Catalogs: Examples from Alaska, the Western United States, and Japan” *Bulletin of the Seismological Society of America,* 90 (2000) 859-869

Zhang, M. and Wen, L, “An effective method for small event detection: match and locate (M & L)” *Geophysical Journal International* 200 (2015) 1523-1537

Appendix A: Seismic stations used in this study.

Station:	Latitude:	Longitude:	Network:	Network Code:	Sensor type:	Datalogger:
K52A	42.78	-80.71	TA	TA	Streckheisen STS-2	Quanterra 330
K54A	42.61	-78.69	TA	TA	Streckheisen STS-2	Quanterra 330
K55A	42.73	-78.07	TA	TA	Streckheisen STS-2	Quanterra 330
K56A	42.70	-77.32	TA	TA	Guralp CMG3T	Quanterra 330
K57A	42.73	-76.52	TA	TA	Streckheisen STS-2	Quanterra 330
K58A	42.76	-75.65	TA	TA	Guralp CMG3T	Quanterra 330
K59A	42.77	-74.85	TA	TA	Streckheisen STS-2	Quanterra 330
K60A	42.62	-73.89	TA	TA	Streckheisen STS-2	Quanterra 330
L53A	41.95	-80.26	TA	TA	Trillium 240	Quanterra 330
L54A	42.23	-79.32	TA	TA	Trillium 240	Quanterra 330
L55A	42.18	-78.44	TA	TA	Trillium 240	Quanterra 330
L56A	42.14	-77.56	TA	TA	Guralp CMG3T	Quanterra 330

L57A	42.00	-76.85	TA	TA	Streckheisen STS-2	Quanterra 330
L58A	42.04	-75.85	TA	TA	Guralp CMG3T	Quanterra 330
L59A	42.19	-75.04	TA	TA	Streckheisen STS-2	Quanterra 330
L60A	41.99	-74.22	TA	TA	Trillium 240	Quanterra 330
M52A	41.54	-81.36	TA	TA	Trillium 240	Quanterra 330
M53A	41.44	-80.67	TA	TA	Trillium 240	Quanterra 330
M54A	41.51	-79.66	TA	TA	Guralp CMG3T	Quanterra 330
M55A	41.47	-78.76	TA	TA	Streckheisen STS-2	Quanterra 330
M56A	41.48	-78.18	TA	TA	Streckheisen STS-2	Quanterra 330
M57A	41.37	-77.02	TA	TA	Streckheisen STS-2	Quanterra 330
M58A	41.37	-76.46	TA	TA	Guralp CMG3T	Quanterra 330
M59A	41.54	-75.43	TA	TA	Streckheisen STS-2	Quanterra 330
M60A	41.33	-74.63	TA	TA	Streckheisen STS-2	Quanterra 330
M61A	41.31	-73.77	TA	TA	Trillium 240	Quanterra 330
N52A	40.81	-81.69	TA	TA	Guralp CMG3T	Quanterra 330
N53A	40.81	-80.84	TA	TA	Trillium 240	Quanterra 330

N54A	40.96	-79.99	TA	TA	Guralp CMG3T	Quanterra 330
N55A	40.78	-78.99	TA	TA	Trillium 240	Quanterra 330
N56A	40.92	-78.30	TA	TA	Streckheisen STS-2	Quanterra 330
N57A	40.73	-77.55	TA	TA	Streckheisen STS-2	Quanterra 330
N58A	40.84	-76.72	TA	TA	Guralp CMG3T	Quanterra 330
N59A	40.92	-75.77	TA	TA	Guralp CMG3T	Quanterra 330
N60A	40.87	-75.10	TA	TA	Streckheisen STS-2	Quanterra 330
N61A	40.75	-74.29	TA	TA	Trillium 240	Quanterra 330
O53A	40.25	-81.21	TA	TA	Streckheisen STS-2	Quanterra 330
O54A	40.18	-80.38	TA	TA	Streckheisen STS-2	Quanterra 330
O55A	40.21	-79.30	TA	TA	Streckheisen STS-2	Quanterra 330
O56A	40.27	-78.57	TA	TA	Guralp CMG3T	Quanterra 330
O57A	40.21	-77.64	TA	TA	Streckheisen STS-2	Quanterra 330
O58A	40.12	-76.92	TA	TA	Streckheisen STS-2	Quanterra 330
O59A	40.31	-76.19	TA	TA	Trillium 240	Quanterra 330

O60A	40.32	-75.41	TA	TA	Streckheisen STS-2	Quanterra 330
O61A	40.09	-74.55	TA	TA	Trillium 240	Quanterra 330
P53A	39.49	-81.39	TA	TA	Guralp CMG3T	Quanterra 330
P54A	39.61	-80.48	TA	TA	Streckheisen STS-2	Quanterra 330
P55A	39.51	-79.83	TA	TA	Streckheisen STS-2	Quanterra 330
P56A	39.50	-78.84	TA	TA	Trillium 240	Quanterra 330
P57A	39.48	-78.01	TA	TA	Streckheisen STS-2	Quanterra 330
P58A	39.49	-77.30	TA	TA	Guralp CMG3T/Streckheisen STS-2	Quanterra 330
P59A	39.61	-76.43	TA	TA	Trillium 240	Quanterra 330
P60A	39.81	-75.64	TA	TA	Streckheisen STS-2	Quanterra 330
P61A	39.67	-74.79	TA	TA	Trillium 240	Quanterra 330
Q53A	38.86	-81.53	TA	TA	Streckheisen STS-2	Quanterra 330
Q54A	38.98	-80.83	TA	TA	Streckheisen STS-2	Quanterra 330
Q55A	39.00	-80.08	TA	TA	Streckheisen STS-2	Quanterra 330

Q56A	39.04	-79.19	TA	TA	Streckheisen STS-2/Trillium 240	Quanterra 330
Q57A	39.04	-78.41	TA	TA	Trillium 240	Quanterra 330
Q58A	38.94	-77.68	TA	TA	Guralp CMG3T	Quanterra 330
Q59A	38.86	-76.65	TA	TA	Streckheisen STS-2	Quanterra 330
Q60A	39.00	-75.84	TA	TA	Trillium 240	Quanterra 330
Q61A	38.88	-75.33	TA	TA	Trillium 240	Quanterra 330
PARB	40.99	-77.20	PASEIS	XY	Compact Trillium	RT130
PACF	41.33	-79.21	PASEIS	XY	Compact Trillium	RT130
PARC	40.50	-80.42	PASEIS	XY	Compact Trillium	RT130
PARS	39.89	-80.44	PASEIS	XY	Compact Trillium	RT130
PACH	41.76	-79.17	PASEIS	XY	Compact Trillium	RT130
PALR	41.73	-77.76	PASEIS	XY	Compact Trillium	RT130
PASH	40.04	-78.63	PASEIS	XY	Compact Trillium	RT130
PSUF	39.94	-79.66	PASEIS	XY	Compact	RT130

					Trillium	
PAYC	40.58	-79.03	PASEIS	XY	Compact Trillium	RT130
PASW	40.50	-76.50	PASEIS	XY	Compact Trillium	RT130
PAHC	41.80	-77.19	PASEIS	XY	Compact Trillium	RT130
PAHR	41.36	-77.63	PASEIS	XY	Compact Trillium	RT130
PAPG	40.03	-77.31	PASEIS	XY	Compact Trillium	RT130
PACW	40.00	-77.92	PASEIS	XY	Compact Trillium	RT130
PAPL	41.32	-75.21	PASEIS	XY	Compact Trillium	RT130
PALW	41.56	-75.70	PASEIS	XY	Compact Trillium	RT130
PALB	40.45	-77.19	PASEIS	XY	Compact Trillium	RT130
PAMC	40.07	-75.73	PASEIS	XY	Compact Trillium	RT130
PAMG	41.43	-80.15	PASEIS	XY	Compact Trillium	RT130

PANP	41.08	-75.87	PASEIS	XY	Compact Trillium	RT130
PSAL	40.54	-78.41	PASEIS	XY	Compact Trillium	RT130
PATY	40.23	-74.95	PASEIS	XY	Compact Trillium	RT130
FMPA	40.05	-76.32	LamontDoherty	LD	Guralp CMG40T	Q730
MVL	40.00	-76.35	LamontDoherty	LD	Guralp CMG3ESP	RT130
LUPA	40.60	-75.37	LamontDoherty	LD	Trillium 120P	RT130
ALLY	41.65	-80.14	LamontDoherty	LD	Guralp CMG3ESP	RT130
TUPA	40.17	75.19	LamontDoherty	LD	Trillium 120P	RT130
KSPA	41.56	75.77	LamontDoherty	LD	Trillium 120P	RT130
PSDB	41.13	-78.75	PASEIS	PE	Guralp CMG3T	Guralp DM24
PAGS	40.23	-76.72	PASEIS	PE	Guralp CMG3T	Guralp DM24
PSUB	39.93	-75.45	PASEIS	PE	Guralp CMG3T	Guralp DM24
PSWB	41.31	-76.02	PASEIS	PE	Guralp CMG3T	Guralp DM24
UPAO	40.48	-80.02	PASEIS	PE	Guralp CMG3T	Guralp DM24
WRPS	40.79	-77.87	PASEIS	PE	Guralp CMG3T	Guralp DM24
SSPA	40.64	-77.89	ANSS	IU	Geotech KS-36000-I Borehole/Trilliu	

					,240	
ERPA	42.12	-79.99	ANSS	US	Streckheisen STS-2	Quanterra 330
BINY	42.20	-75.99	ANSS	US	Streckheisen STS-2	Quanterra 330
MCWV	39.66	-79.85	ANSS	US	Streckheisen STS-2	Quanterra 330

Appendix B: Data Processing Procedure

PASEIS data were gathered and processed every other month until August 2014, at which point the period extended to every four months. Data processing began by exchanging the full compact flash (CF) cards from each RT130 datalogger with empty CF cards. The RekTek RT130's store the data as rt files which then needed to be converted to ref files. This was done for each station via Passcal's *rt130cut* code. *rt130cut* takes the raw data files from an RT130 datalogger and combines them into a single raw .ref file. The ref files were then converted to miniseed files via the *ref2mseed code*. Once miniseed files were created, quality control was done by visually inspecting some waveforms and using the *logpeek* program to identify timing errors, power problems, and phase errors. After quality control, the file headers were fixed using Passcal's *fixhdr* code. *fixhdr* allows the user to manipulate the miniseed file headers to change the endianess, station name, channel name, location code, and network code. This program also allows flagging any suspicious timing errors. Once the headers were fixed for the miniseed files, the data was sent to Incorporated Research Institutions for Seismology (IRIS) for archival.

Appendix C: PASEIS Catalog

PASEIS Catalog of Seismic Events from February 2013 to December 2014

Date: YYYYMMDD
hhmm: Hour and Minute of origin time
Sec: Seconds of origin time
Latitude: In degrees
Longitude: In degrees
Depth: km
N: number of stations used in location
D1: Distance to nearest station (km)
Gap: Primary azimuthal gap in degrees
RMS: Overall rms of arrival times in seconds
seh, seh, sez: Horizontal an dvertical single variable standard deviations of error ellipse (68% - one degree of freedom; max 99 km)
Mag: M_L calculated by Antelope ($M_L = \frac{Log(Amp)}{Log(10)} + distance\ correction$)

Events within Pennsylvania

Date	hhmm	Sec	Latitude	Longitude	Depth	Mag	N	D1	Gap	RMS	SEH	SEH	SEZ
20130207	1556	38.58	40.80	-78.33	0.1	2.3	6	39	118	0.16	0.3	0.4	99.0
20130208	1935	31.99	41.12	-79.55	5.1	2.6	10	37	69	0.53	0.3	0.4	0.8
20130209	1929	23.92	40.02	-78.70	6.1	2.0	5	30	270	0.19	0.6	2.8	0.7
20130211	2122	34.69	40.93	-79.20	3.7	2.1	10	24	74	0.88	0.3	0.3	0.8
20130215	1528	40.91	41.09	-79.54	0.0	1.8	6	38	123	0.38	0.4	0.5	2.3
20130218	1744	59.06	40.95	-79.07	0.0	2.6	10	20	78	0.89	0.2	0.4	2.3
20130218	1922	42.49	40.80	-78.55	5.3	2.0	9	31	104	0.46	0.3	0.4	1.3
20130219	953	3.24	41.26	-77.07	10.6	2.3	16	85	99	0.35	0.2	0.4	0.5
20130219	1814	46.06	40.88	-78.20	0.9	2.0	8	38	171	0.64	0.3	0.6	1.0
20130220	1704	27.17	40.79	-78.56	0.0	2.1	5	31	130	0.37	0.3	0.5	99.0
20130220	2217	37.03	41.47	-77.37	0.3	2.5	21	86	108	0.73	0.2	0.3	0.5
20130221	2017	23.26	41.15	-79.59	7.7	2.6	22	38	48	0.90	0.2	0.3	0.4
20130225	1642	24.22	40.73	-78.26	25.0	1.7	8	24	99	0.73	0.4	0.5	0.8
20130225	1747	44.4	40.89	-79.18	0.0	1.9	7	20	151	0.40	0.4	0.5	2.2
20130226	1921	54.82	41.08	-79.50	0.1	2.7	12	37	54	0.53	0.3	0.3	0.7
20130227	1625	52.17	40.79	-78.28	0.0	2.0	6	29	122	0.91	0.4	0.8	4.1
20130301	1807	52.45	40.80	-78.67	0.0	1.8	6	28	116	0.44	0.3	0.4	99.0
20130304	1726	43.46	40.78	-79.44	37.1	2.1	6	38	151	0.33	0.5	1.1	2.5
20130305	2027	18.44	40.80	-78.69	0.0	1.9	7	25	112	0.37	0.3	0.4	99.0
20130305	2051	22.11	41.12	-79.52	1.9	2.3	13	35	57	0.68	0.2	0.3	0.8
20130311	1514	9.49	40.69	-76.83	0.0	2.1	11	52	228	0.48	0.5	1.0	1.1
20130311	1849	5.04	40.79	-78.19	8.2	1.8	6	31	180	0.42	0.6	0.6	1.4
20130311	1904	15	41.08	-79.52	0.0	2.4	15	38	55	0.77	0.2	0.3	0.7

20130312	1616	2.12	41.31	-78.73	0.1	2.5	18	18	90	1.09	0.2	0.3	0.5
20130312	1831	15.1	40.89	-78.25	0.0	2.3	17	34	67	0.79	0.2	0.3	0.5
20130313	1645	31.05	40.51	-78.45	0.0	2.3	9	5	153	0.47	0.3	0.4	1.6
20130315	1423	39.91	41.09	-79.51	0.1	2.4	18	37	55	0.50	0.2	0.2	0.6
20130315	2004	48.28	41.07	-79.50	8.1	2.0	14	38	53	0.67	0.3	0.3	0.6
20130318	1711	6.04	40.58	-79.08	0.0	1.8	7	4	99	0.59	0.4	0.5	3.4
20130318	1914	33.58	40.35	-78.80	0.0	2.1	7	22	93	0.12	0.3	0.4	99.0
20130319	1645	1.22	41.35	-78.57	0.0	2.0	6	21	148	0.57	0.4	0.5	2.4
20130320	1644	11.13	41.14	-78.30	0.0	2.2	7	38	182	0.40	0.3	0.6	1.1
20130321	1409	4.85	41.13	-79.57	8.5	2.0	12	38	59	0.80	0.3	0.3	0.6
20130322	1831	15.94	40.31	-78.72	0.0	2.8	14	14	93	0.76	0.3	0.3	0.6
20130323	1216	42.57	41.13	-79.48	5.1	1.9	11	32	76	0.68	0.3	0.4	0.8
20130325	1757	42.96	40.34	-78.77	0.0	2.2	13	19	57	0.67	0.3	0.3	0.7
20130327	1535	22.52	41.24	-78.60	0.0	2.1	8	17	106	1.04	0.3	0.4	1.0
20130327	1930	4.34	41.47	-77.36	3.0	2.5	19	26	94	0.69	0.3	0.3	0.5
20130328	1629	9.29	40.40	-80.37	4.5	2.1	15	25	98	1.05	0.2	0.3	0.6
20130328	1906	27.39	40.74	-78.32	31.7	1.7	7	23	122	0.63	0.5	0.5	0.8
20130328	1914	55.91	41.15	-78.63	0.0	2.0	8	10	194	0.72	0.3	0.7	1.0
20130328	1959	34.16	41.47	-77.36	0.1	2.5	19	25	70	0.67	0.2	0.3	0.5
20130329	1601	33.27	40.63	-79.18	11.7	2.0	8	14	179	0.96	0.4	0.6	0.9
20130329	1746	0.63	41.12	-79.53	8.6	1.5	6	35	115	0.53	0.3	0.4	1.1
20130330	1830	22.18	40.22	-78.78	0.0	1.7	11	19	74	0.72	0.3	0.3	0.7
20130401	1749	42.44	41.12	-78.32	0.3	2.1	16	36	101	0.42	0.2	0.3	0.5
20130402	2012	54.65	41.12	-79.55	0.0	2.4	12	37	104	0.47	0.2	0.4	0.6
20130403	1644	15.04	40.47	-78.49	0.0	2.1	8	10	124	0.26	0.3	0.4	1.0
20130404	1510	29.1	40.96	-78.47	3.8	2.2	9	30	149	0.74	0.3	0.5	0.8
20130404	1635	56.32	40.61	-79.08	0.0	1.9	9	5	94	0.82	0.3	0.4	2.5
20130405	1605	53.92	40.55	-78.48	0.0	2.5	22	6	77	0.44	0.2	0.3	0.5
20130405	1654	16.95	40.65	-78.46	0.0	2.0	8	13	107	0.57	0.3	0.4	99.0
20130405	1700	43.19	40.95	-80.51	7.7	2.1	17	32	105	0.89	0.2	0.3	0.5
20130405	1902	8.49	41.08	-79.53	0.1	2.3	11	38	97	0.90	0.3	0.4	0.7
20130405	2017	34.55	41.01	-78.67	0.0	2.1	7	15	131	0.92	0.3	0.5	1.1
20130409	1455	51.86	39.82	-79.91	0.0	2.5	12	35	86	0.73	0.3	0.4	0.7
20130412	1408	2.4	41.31	-78.62	0.0	2.4	6	21	192	0.69	0.4	1.3	5.2
20130415	1433	49.81	40.64	-78.17	0.1	1.6	5	23	133	0.20	0.3	0.7	99.0
20130416	1554	42.38	40.77	-78.43	0.0	1.8	5	25	127	0.33	0.4	0.5	99.0
20130416	1832	20.33	41.10	-79.54	0.0	2.8	17	38	94	0.76	0.2	0.3	0.5
20130417	1702	30.76	40.81	-76.38	0.0	2.2	11	71	81	0.88	0.3	0.4	0.8
20130417	1849	37.55	41.49	-77.38	3.6	2.2	16	25	61	0.34	0.2	0.3	0.5
20130418	1341	55.43	40.85	-78.39	0.0	1.8	9	34	93	0.70	0.3	0.4	2.4
20130418	1403	46.15	41.14	-78.28	0.0	1.9	6	40	113	0.23	0.3	0.4	99.0
20130418	1426	0.25	41.18	-79.56	10.5	2.6	10	33	111	0.65	0.3	0.5	0.7
20130419	1839	4.57	41.13	-78.34	31.1	2.2	7	35	110	0.37	0.4	0.5	1.0
20130422	1619	30.03	40.33	-78.78	0.2	2.0	6	20	96	0.71	0.4	0.4	2.5
20130423	1835	13.8	41.48	-77.37	0.0	2.3	24	25	63	0.51	0.2	0.2	0.5
20130425	1359	23.79	40.77	-75.83	4.8	2.0	7	18	224	0.28	0.4	1.7	1.2
20130425	1456	2.76	41.29	-75.76	0.0	1.6	6	24	156	0.65	0.3	0.6	2.4
20130425	1515	27.49	40.77	-76.23	0.0	1.7	4	38	150	0.22	0.4	1.9	5.4
20130425	1542	49.05	39.90	-79.00	0.0	1.9	5	35	175	0.52	0.4	0.6	99.0
20130425	1616	43.83	40.37	-78.79	0.1	1.9	6	22	92	0.10	0.4	0.4	2.5

20130425	1634	37.46	41.10	-79.48	12.3	2.4	11	34	110	0.80	0.3	0.3	0.7
20130425	2106	56.52	40.85	-78.24	0.1	1.8	6	37	138	0.45	0.3	0.5	99.0
20130426	1300	56.81	41.00	-78.33	26.1	1.7	6	51	203	0.53	0.4	0.9	0.9
20130426	1348	20.22	40.64	-76.29	0.0	1.9	9	54	165	0.88	0.3	0.7	1.1
20130426	1532	33.93	40.80	-75.94	0.0	1.5	6	20	218	0.76	0.4	1.3	3.3
20130426	1836	3.29	41.27	-78.59	0.0	2.0	9	21	96	0.79	0.3	0.4	1.0
20130426	1900	6.67	40.80	-78.21	6.7	1.6	7	29	130	0.38	0.3	0.6	1.3
20130429	1250	20.58	40.82	-78.66	0.0	1.1	4	28	156	0.29	0.4	0.6	99.0
20130429	1336	5.79	40.83	-76.29	0.2	1.5	4	41	206	0.24	0.4	1.3	99.0
20130429	1512	19.4	41.14	-78.35	0.1	2.2	19	34	111	0.62	0.2	0.3	0.4
20130429	1604	46.74	40.93	-78.44	0.0	2.1	9	34	149	1.04	0.3	0.5	99.0
20130429	1744	6.35	41.12	-80.03	6.6	1.9	10	18	74	0.34	0.3	0.3	0.8
20130429	1844	34.63	41.12	-79.56	24.0	1.3	6	37	106	0.41	0.4	0.6	1.0
20130430	1520	47.3	41.32	-78.62	0.0	2.0	6	21	243	0.86	0.4	1.3	99.0
20130430	1536	19.77	40.83	-75.89	0.0	1.4	6	14	158	0.27	0.3	0.8	99.0
20130430	1605	23.68	41.46	-75.57	0.0	1.7	9	16	164	0.42	0.3	0.5	1.0
20130501	1602	35.17	39.73	-79.73	4.2	2.1	14	26	131	0.68	0.3	0.4	0.6
20130501	1721	56.23	41.13	-79.49	4.1	2.5	13	33	65	0.57	0.2	0.3	0.6
20130501	1826	46.03	41.08	-79.84	6.9	2.2	18	18	76	0.93	0.2	0.3	0.5
20130502	1324	56.61	40.79	-75.66	0.0	1.5	7	17	188	1.14	0.4	0.8	2.6
20130502	1506	25.86	41.11	-78.05	0.0	2.2	5	54	280	0.56	0.7	2.6	2.3
20130502	1739	13.33	41.15	-79.98	1.0	2.1	7	21	92	0.24	0.3	0.6	1.1
20130502	2020	55.85	41.48	-77.38	0.0	2.5	39	25	46	0.62	0.1	0.2	0.4
20130503	1748	10.78	40.43	-78.53	0.0	1.5	7	16	123	0.43	0.3	0.4	99.0
20130503	1835	21.68	41.47	-77.35	0.1	2.7	45	27	42	0.70	0.1	0.2	0.4
20130504	1206	3.54	40.82	-78.20	0.1	2.0	14	28	79	0.68	0.2	0.3	0.7
20130506	1258	45.59	40.68	-76.03	0.0	1.4	5	34	160	0.48	0.3	0.6	99.0
20130506	1320	17.58	40.81	-75.88	1.2	1.4	8	15	161	0.19	0.3	0.6	1.1
20130506	1548	56.07	41.28	-78.60	0.0	2.2	6	21	244	0.94	0.4	1.3	33.3
20130506	1711	11.37	41.46	-77.37	0.1	2.3	24	24	69	0.56	0.2	0.3	0.5
20130506	1723	25.56	41.11	-79.51	0.1	2.5	13	35	98	0.58	0.2	0.3	0.6
20130506	1911	31.45	40.55	-79.07	0.2	1.7	8	5	75	1.01	0.3	0.4	2.5
20130507	1620	4.85	40.40	-80.39	2.5	1.9	9	12	76	0.69	0.3	0.3	1.7
20130507	1800	42.35	40.27	-75.86	5.9	1.2	8	24	71	0.25	0.3	0.4	0.8
20130507	1807	28.51	41.17	-80.00	1.1	2.2	15	23	97	0.61	0.2	0.3	0.5
20130507	1825	3.9	40.79	-78.19	14.8	1.9	10	27	85	0.34	0.3	0.5	1.0
20130508	1330	42.51	40.86	-76.43	0.0	1.6	6	40	139	0.42	0.4	0.5	1.1
20130508	1400	56.59	40.93	-75.96	0.2	1.6	11	16	74	0.48	0.3	0.4	1.0
20130508	1402	51.64	40.75	-76.10	0.0	1.9	10	34	133	0.48	0.3	0.5	1.1
20130508	1513	18.2	40.84	-75.91	0.0	1.6	5	15	150	0.32	0.3	0.9	99.0
20130508	1636	48.75	40.49	-78.90	0.0	1.5	6	15	95	0.13	0.3	0.4	99.0
20130508	1700	56.51	40.99	-75.89	0.0	2.9	29	11	70	0.79	0.2	0.3	0.4
20130509	1212	21.91	40.70	-76.11	4.7	1.5	9	38	141	0.24	0.3	0.6	1.1
20130509	1316	32.92	40.79	-75.86	0.0	1.7	8	16	165	0.69	0.3	0.7	1.2
20130509	1512	38.9	40.41	-79.42	6.8	2.0	7	24	245	0.27	0.4	1.3	0.6
20130509	1602	23.43	39.77	-79.78	0.1	2.0	18	13	69	0.80	0.2	0.3	0.5
20130509	1641	29.02	40.54	-78.46	0.0	2.0	12	4	98	0.51	0.2	0.3	1.3
20130509	1958	23.99	41.13	-78.24	0.3	1.9	15	43	111	0.67	0.2	0.3	0.6
20130510	1319	34.81	40.85	-78.40	0.0	1.5	8	34	91	0.42	0.3	0.4	99.0
20130510	1401	55.62	40.81	-76.28	0.0	2.3	18	38	98	0.86	0.2	0.4	0.7

20130510	1419	46.81	40.73	-76.48	0.0	1.6	6	26	148	0.56	0.3	0.5	99.0
20130510	1518	41.27	40.04	-78.96	1.4	1.9	14	29	211	0.77	0.2	0.6	0.6
20130510	1520	23.08	40.35	-78.83	0.0	1.7	7	25	95	0.43	0.3	0.4	99.0
20130510	1548	48.01	41.25	-78.55	0.0	2.0	5	21	115	0.69	0.4	0.6	3.0
20130510	1551	48.28	40.59	-79.06	0.9	2.5	24	2	69	0.75	0.2	0.2	0.4
20130510	1641	23.88	41.12	-79.54	5.6	2.7	13	36	102	0.77	0.3	0.3	0.5
20130510	1712	21.4	41.10	-78.35	0.1	1.8	5	34	183	0.30	0.4	0.7	99.0
20130510	1716	4.08	41.13	-78.52	9.9	1.5	5	55	139	0.44	0.4	0.5	33.3
20130510	1825	20.52	40.89	-77.63	0.0	1.9	9	23	96	1.01	0.3	0.4	1.0
20130510	2045	37.09	40.93	-78.45	0.1	1.9	8	33	79	0.18	0.3	0.3	99.0
20130513	1833	25.94	40.91	-78.25	6.3	2.2	19	35	73	0.68	0.2	0.3	0.5
20130514	1133	53.57	41.24	-78.29	23.7	2.0	5	57	245	0.97	0.6	1.6	0.8
20130514	1406	3.19	40.11	-79.57	10.2	1.9	8	20	172	0.59	0.3	0.8	0.9
20130514	1440	55.46	40.69	-78.42	5.5	2.0	8	17	176	0.54	0.4	0.6	0.6
20130514	1640	35.19	41.12	-78.26	0.0	2.0	9	41	110	0.66	0.3	0.3	99.0
20130514	1712	52.8	40.81	-78.19	0.0	1.9	6	31	130	0.40	0.4	0.5	1.0
20130514	1907	5	40.86	-78.23	12.7	2.0	11	31	97	0.43	0.3	0.4	0.9
20130515	1701	2.42	40.12	-76.38	5.7	1.6	5	9	212	0.07	0.4	0.9	1.6
20130515	1711	8.54	40.11	-78.70	1.3	2.1	8	9	142	0.24	0.4	0.5	0.9
20130515	1734	40.1	41.17	-78.26	34.4	2.0	8	41	118	0.49	0.4	0.5	0.6
20130515	1844	52.29	40.89	-78.26	3.1	2.4	21	41	79	0.72	0.2	0.3	0.4
20130515	1849	45.74	40.91	-79.68	14.1	2.0	10	27	79	0.59	0.3	0.4	0.7
20130516	1357	16.59	41.11	-79.51	8.0	2.2	11	35	97	0.40	0.3	0.4	0.6
20130516	1836	38.19	40.73	-75.97	17.2	1.7	10	27	120	0.70	0.3	0.5	0.7
20130516	1855	11.4	40.89	-76.19	0.0	2.1	16	35	118	0.99	0.2	0.3	0.7
20130516	1904	19.49	40.86	-78.23	3.5	2.5	34	38	53	0.58	0.2	0.2	0.3
20130516	2006	50.18	40.06	-78.96	0.1	1.9	9	29	205	0.63	0.3	0.8	0.7
20130516	2019	51.1	40.82	-78.68	0.0	2.1	6	27	153	0.58	0.4	0.5	99.0
20130517	1258	36.66	41.04	-76.73	0.0	2.0	12	40	129	0.63	0.2	0.4	0.7
20130517	1516	27.6	40.80	-76.27	21.6	1.9	9	39	109	0.72	0.4	0.4	0.7
20130517	1625	33.64	40.46	-78.91	0.1	1.8	6	17	92	0.24	0.3	0.4	99.0
20130517	1707	17.32	40.56	-79.25	0.0	2.4	12	19	120	1.06	0.3	0.4	0.7
20130517	1927	49.97	41.11	-78.31	0.1	2.1	9	37	106	0.59	0.3	0.3	99.0
20130518	1525	48.55	41.03	-79.87	4.2	2.3	12	13	99	0.82	0.3	0.5	0.7
20130518	1816	1.4	40.27	-78.71	0.1	1.7	9	12	94	1.10	0.3	0.3	1.4
20130520	1317	27.92	40.73	-76.05	8.4	1.7	6	31	146	0.08	0.3	1.0	1.9
20130520	1451	37.47	40.90	-78.24	0.0	2.0	6	33	212	0.47	0.3	0.9	99.0
20130520	1535	14.28	41.33	-78.68	2.0	2.3	9	17	140	0.80	0.3	0.7	1.5
20130520	1551	19.62	40.99	-75.89	0.0	1.8	8	11	99	0.45	0.3	0.4	99.0
20130520	1815	58.18	40.33	-75.70	0.1	1.8	7	29	157	0.98	0.4	1.2	5.6
20130520	2004	17.2	40.81	-78.68	0.0	1.9	5	36	122	0.51	0.4	0.5	99.0
20130521	1511	28.59	40.46	-78.50	0.0	1.8	6	12	124	0.40	0.3	0.4	99.0
20130521	1651	25.93	41.07	-79.82	0.0	2.0	7	19	148	1.03	0.3	0.5	2.4
20130521	1825	45.96	41.11	-79.54	11.6	2.4	10	37	102	0.49	0.3	0.4	1.0
20130521	1856	26.01	41.04	-79.11	0.1	1.4	6	30	103	0.65	0.4	0.4	99.0
20130521	2022	34.66	40.37	-78.83	0.0	1.8	9	25	91	0.66	0.3	0.4	1.7
20130522	1408	55.84	40.70	-76.42	1.0	1.8	12	23	117	1.06	0.2	0.4	0.7
20130522	1423	33.99	40.91	-78.21	0.0	2.1	7	41	107	0.27	0.3	0.4	99.0
20130522	1612	59.41	41.01	-75.95	0.0	1.6	7	10	110	0.40	0.3	0.4	99.0
20130522	1722	0.09	40.06	-79.28	0.0	2.0	16	17	102	0.63	0.3	0.3	0.6

20130522	1815	12.97	40.99	-78.49	3.4	2.2	15	27	82	0.57	0.2	0.3	0.8
20130522	2012	36.63	39.81	-79.96	14.6	2.3	11	30	101	0.60	0.3	0.4	0.9
20130523	1528	32.85	40.67	-78.46	0.0	1.8	7	15	111	0.73	0.3	0.4	99.0
20130523	1718	49.11	40.37	-78.81	0.2	1.8	5	24	98	0.15	0.4	0.4	99.0
20130523	1816	16.27	40.59	-79.04	0.0	2.3	17	1	67	0.85	0.2	0.2	0.8
20130523	1939	43.98	41.07	-78.33	0.1	2.0	13	17	78	0.68	0.2	0.3	0.6
20130524	1425	4.38	41.01	-78.21	0.0	1.8	10	12	84	0.57	0.3	0.3	1.1
20130524	1816	17.76	40.83	-79.72	12.4	2.1	6	27	150	0.79	0.4	0.6	1.1
20130528	1523	43.47	40.84	-76.08	0.0	1.3	5	28	157	0.18	0.3	0.8	99.0
20130528	1933	46.33	40.97	-78.40	0.0	1.8	9	10	104	0.55	0.3	0.3	99.0
20130529	1747	51.02	40.83	-78.29	0.0	1.8	11	10	90	0.73	0.3	0.3	99.0
20130529	1837	31.69	41.49	-77.38	0.0	2.2	23	41	108	0.81	0.2	0.3	0.5
20130529	1904	53.33	41.06	-78.29	0.1	2.1	14	16	64	0.62	0.2	0.3	99.0
20130529	1926	4.81	40.86	-78.22	0.0	1.9	12	10	79	0.75	0.2	0.3	0.9
20130530	1417	9.36	41.17	-78.04	4.1	1.9	12	35	103	0.58	0.3	0.4	0.7
20130530	1746	4.02	41.51	-77.36	0.6	2.4	35	41	110	0.74	0.2	0.2	0.4
20130530	1916	52.42	40.86	-79.72	14.2	1.9	10	25	143	0.54	0.3	0.6	0.6
20130531	1437	5.44	40.84	-78.21	0.1	1.9	20	12	77	0.71	0.2	0.2	0.6
20130531	1512	59.32	41.10	-78.33	5.8	2.3	11	21	105	0.34	0.3	0.4	1.1
20130531	1548	0.33	41.07	-75.79	7.5	1.6	6	7	116	0.25	0.3	0.5	0.8
20130531	1650	42.89	40.83	-79.02	15.7	1.6	7	6	160	0.88	0.4	0.6	0.5
20130603	1445	33.78	40.84	-75.92	2.6	1.8	11	16	148	0.36	0.3	0.7	1.1
20130604	1355	26.19	40.63	-76.48	3.1	1.8	7	43	147	1.20	0.3	0.6	1.0
20130604	1415	21.09	40.00	-79.42	8.1	1.8	6	22	130	0.15	0.4	1.6	3.0
20130604	1446	19.63	40.86	-78.21	0.0	2.0	11	10	101	0.55	0.3	0.4	0.7
20130604	1630	6.18	40.79	-76.26	4.8	1.9	11	38	110	0.42	0.3	0.5	0.7
20130604	1634	51.01	40.08	-79.52	6.4	2.0	5	19	150	0.37	0.4	1.4	2.0
20130604	1745	50.42	41.48	-77.35	0.0	2.6	43	44	77	0.75	0.1	0.2	0.4
20130606	1601	25.45	41.46	-77.37	0.0	2.2	28	44	76	0.85	0.2	0.3	0.5
20130606	1718	51.47	40.56	-79.04	5.3	2.3	16	25	70	0.94	0.2	0.3	0.5
20130606	1901	8.4	39.83	-79.95	0.0	2.5	15	21	78	0.42	0.3	0.3	0.6
20130607	1605	3.03	41.09	-78.33	0.1	2.4	22	19	59	0.49	0.2	0.3	0.4
20130607	1751	55.25	41.14	-79.55	6.0	2.3	13	36	105	0.36	0.3	0.4	0.6
20130607	1818	23	40.81	-76.08	0.1	1.9	14	29	116	0.64	0.2	0.4	0.6
20130611	1425	30.27	40.48	-78.90	0.1	1.9	6	16	101	0.21	0.3	0.4	99.0
20130611	1550	15.74	40.78	-78.41	0.0	1.7	8	18	92	0.74	0.3	0.4	2.5
20130612	1633	34.29	41.12	-78.30	6.0	2.2	22	23	62	0.52	0.2	0.3	0.4
20130613	1903	25.83	40.35	-78.80	0.1	2.3	8	22	93	0.58	0.3	0.4	2.3
20130617	1645	11.05	40.92	-78.26	0.1	2.2	15	3	103	0.87	0.3	0.3	0.5
20130618	1853	30.94	40.82	-78.68	5.0	2.0	12	26	54	0.71	0.2	0.3	0.6
20130618	1929	17.75	40.86	-78.23	1.7	1.9	8	9	101	0.49	0.3	0.4	1.7
20130619	1330	37.23	40.78	-76.23	3.1	1.7	7	39	108	0.36	0.3	1.0	1.6
20130620	1352	48.26	40.91	-78.26	0.0	1.7	6	4	103	0.50	0.4	0.4	99.0
20130620	1501	3.97	41.13	-78.10	0.9	2.1	16	29	85	0.66	0.2	0.3	0.5
20130620	1716	13.74	40.81	-79.41	7.1	2.2	10	36	117	0.18	0.3	0.4	1.0
20130620	1821	40.71	40.83	-78.69	1.2	2.2	15	26	65	0.40	0.2	0.3	0.7
20130620	1900	12.07	41.48	-77.35	0.1	2.6	42	44	77	0.72	0.1	0.2	0.4
20130621	1259	12.67	41.11	-79.49	10.7	2.4	15	34	54	0.75	0.3	0.3	0.6
20130621	1752	2.41	40.60	-79.92	0.1	2.2	8	69	111	0.60	0.3	0.4	2.5
20130621	2011	55.04	40.92	-78.68	15.1	2.0	9	31	115	0.75	0.3	0.4	0.8

20130624	1523	54.53	41.10	-78.34	0.0	1.7	10	21	104	0.86	0.3	0.4	0.9
20130624	1738	18.54	40.29	-80.11	0.1	1.9	8	26	70	0.86	0.3	0.4	99.0
20130624	1901	43.07	40.80	-78.69	0.0	1.9	10	26	76	0.40	0.3	0.3	99.0
20130624	2000	31.24	40.85	-78.18	0.1	2.2	13	13	65	0.79	0.3	0.3	0.7
20130625	1439	7.3	40.79	-76.12	0.0	1.6	8	33	122	0.81	0.3	0.5	0.9
20130625	1547	58.15	41.18	-78.02	0.0	2.0	15	36	80	1.01	0.2	0.3	0.5
20130625	1633	40.68	40.57	-79.03	0.2	2.0	12	2	73	0.84	0.3	0.3	0.9
20130626	1511	2.69	40.71	-76.18	3.6	1.4	8	35	125	0.57	0.3	0.6	1.1
20130626	1601	8.7	40.58	-79.02	5.2	1.9	10	1	95	0.84	0.3	0.3	0.4
20130626	1603	6.04	40.86	-78.68	3.1	2.0	8	27	188	0.39	0.3	0.8	0.6
20130626	1606	8.01	40.96	-75.90	0.0	2.0	14	12	85	0.56	0.2	0.4	0.8
20130626	1748	26.16	39.98	-76.03	20.7	1.5	8	26	101	0.39	0.4	0.5	0.8
20130626	1753	51.59	40.45	-77.86	0.2	1.6	8	32	107	0.46	0.3	0.4	0.9
20130626	1958	42.24	41.13	-79.52	3.5	2.4	25	43	42	0.74	0.2	0.2	0.4
20130626	2119	1.16	40.86	-78.22	0.1	2.2	23	9	40	0.56	0.2	0.2	0.4
20130627	1429	5.63	40.93	-78.27	0.0	2.3	21	3	62	0.67	0.2	0.3	0.4
20130628	2048	18.77	40.89	-78.25	0.0	2.3	29	6	47	0.74	0.2	0.2	0.4
20130701	1405	29.06	41.31	-75.73	0.0	1.6	10	27	91	0.68	0.2	0.4	1.7
20130701	1447	37.63	40.85	-78.23	0.0	1.8	13	10	61	0.69	0.2	0.3	1.3
20130701	1635	15.15	39.76	-79.59	3.6	2.0	13	21	144	0.56	0.3	0.4	0.6
20130701	1647	5.71	40.89	-78.27	2.3	2.2	16	4	41	0.86	0.2	0.3	0.4
20130701	1650	27.2	40.81	-76.16	3.9	1.4	7	35	113	0.23	0.3	1.0	2.9
20130701	1918	0.1	39.85	-79.95	3.7	2.4	18	28	76	0.64	0.3	0.3	0.5
20130701	2003	58.67	41.08	-78.39	0.0	1.6	5	20	97	1.01	0.3	0.4	99.0
20130702	1501	39.75	40.74	-76.59	2.3	1.5	11	59	95	0.56	0.2	0.5	0.9
20130702	1637	55.28	40.56	-79.06	0.0	2.0	9	4	96	0.84	0.3	0.6	1.1
20130703	54	24.54	40.22	-79.32	1.1	1.7	25	2	53	0.79	0.2	0.2	0.4
20130703	56	16.28	40.24	-79.34	0.0	1.7	24	5	52	0.66	0.2	0.2	0.5
20130703	1502	56.68	41.12	-78.32	1.1	1.9	20	22	59	0.59	0.2	0.2	0.5
20130703	1603	7.97	40.88	-78.22	1.6	2.0	12	8	69	0.70	0.2	0.3	1.7
20130703	1626	23.51	40.86	-78.21	0.0	2.3	38	10	22	0.80	0.2	0.2	0.3
20130703	1634	5.53	40.76	-76.50	0.0	2.3	29	56	69	0.75	0.2	0.2	0.4
20130703	1641	17.59	40.46	-77.87	0.0	1.5	8	19	97	0.50	0.3	0.4	99.0
20130703	1722	8.18	40.27	-80.12	0.1	1.9	12	25	70	0.62	0.3	0.3	0.7
20130705	1222	35.44	40.91	-78.24	0.1	2.2	33	5	37	0.73	0.2	0.2	0.4
20130705	1731	46.63	41.27	-78.76	0.0	2.1	19	16	64	0.72	0.2	0.3	0.5
20130705	1750	3.28	40.86	-78.22	0.0	1.7	10	9	72	0.59	0.3	0.3	2.2
20130708	1602	55.1	41.31	-75.81	1.5	1.5	10	17	100	0.53	0.3	0.4	2.0
20130708	1649	33.4	41.12	-78.30	1.2	2.1	17	23	59	0.61	0.2	0.2	0.6
20130708	1841	55.04	41.00	-80.24	7.3	2.2	17	22	76	1.06	0.2	0.3	0.5
20130709	1444	45.8	40.79	-76.25	0.1	1.9	20	40	104	0.63	0.2	0.3	0.6
20130709	1543	44.23	39.82	-79.07	1.0	1.9	12	41	74	0.73	0.2	0.3	0.6
20130709	1649	8.25	41.09	-78.36	0.0	2.0	11	20	58	0.49	0.3	0.3	2.2
20130710	1341	50.15	40.90	-78.24	0.1	2.2	25	6	50	0.64	0.2	0.2	0.4
20130710	1616	58.37	41.07	-78.35	0.0	1.8	14	17	55	0.49	0.2	0.3	0.9
20130710	1719	36.94	40.13	-78.73	2.1	2.0	12	21	93	0.39	0.3	0.3	0.8
20130710	1737	42.57	40.92	-78.79	0.0	1.8	13	22	124	0.47	0.2	0.3	1.8
20130710	1741	55.34	39.84	-77.37	0.1	1.6	8	22	120	0.96	0.3	0.4	99.0
20130710	1832	27.8	40.84	-78.23	0.0	2.0	16	10	60	0.95	0.2	0.2	0.9
20130711	1221	32.65	40.81	-75.87	1.8	2.0	22	15	88	0.50	0.2	0.3	0.6

20130711	1605	27.96	40.49	-79.00	0.0	1.9	13	11	66	0.74	0.2	0.3	0.8
20130711	1611	51.54	41.30	-75.82	0.1	1.7	11	17	90	0.51	0.3	0.3	1.7
20130711	1629	46.2	39.98	-79.42	0.1	2.0	11	21	100	0.81	0.2	0.3	0.9
20130712	1258	57.5	41.00	-76.70	5.0	1.8	17	18	89	0.65	0.2	0.3	0.5
20130712	1549	20.76	40.68	-76.21	2.0	1.7	12	41	123	0.71	0.2	0.4	0.8
20130712	1612	52.08	39.75	-79.74	3.4	1.8	16	23	80	0.75	0.2	0.3	0.5
20130712	1706	49.65	40.80	-78.51	0.0	1.9	7	22	111	0.56	0.3	0.4	99.0
20130715	1456	3.22	40.95	-78.46	0.0	2.1	8	14	145	0.46	0.3	0.5	2.5
20130716	358	9.51	39.86	-77.59	0.0	1.9	34	31	62	0.54	0.2	0.2	0.4
20130716	1303	59.48	40.81	-76.42	2.0	1.5	10	26	140	0.76	0.2	0.5	0.8
20130716	1338	26.63	40.80	-76.26	0.0	1.9	9	39	102	0.79	0.3	0.4	1.0
20130716	1444	55.56	40.68	-78.48	2.1	2.2	31	17	45	0.83	0.2	0.2	0.3
20130716	1459	1.77	41.63	-75.90	0.0	1.6	7	13	126	0.22	0.3	0.4	99.0
20130716	1648	55.79	40.34	-80.46	14.6	2.2	13	19	147	0.75	0.3	0.5	0.5
20130716	1818	29.66	41.14	-78.29	0.0	2.2	14	25	61	0.53	0.2	0.3	0.9
20130716	1859	34.46	40.98	-75.95	0.0	1.5	9	14	144	0.33	0.3	0.4	2.6
20130717	1402	24.04	40.92	-76.89	9.7	1.7	16	17	87	0.78	0.2	0.3	0.7
20130717	1507	1.28	40.62	-78.13	0.0	1.8	10	20	86	0.56	0.3	0.4	0.9
20130717	1750	11.12	40.85	-76.15	1.6	1.9	26	33	61	0.86	0.2	0.2	0.5
20130717	1837	15.36	41.13	-79.52	0.0	2.5	20	43	58	0.81	0.2	0.3	0.4
20130717	1854	17.25	40.91	-78.23	0.0	2.0	20	6	64	0.82	0.2	0.2	0.5
20130717	1932	25.4	39.78	-79.62	0.0	1.6	7	19	97	0.63	0.3	0.4	99.0
20130718	451	49.32	39.86	-77.59	0.1	1.7	16	31	43	0.63	0.2	0.3	0.7
20130718	1250	42.87	40.89	-78.38	7.2	1.6	6	8	167	0.56	0.4	1.0	2.4
20130718	1257	57.59	41.27	-76.06	0.0	1.2	7	5	145	0.42	0.4	0.4	99.0
20130718	1338	51.89	40.82	-75.89	0.0	1.6	14	15	98	0.61	0.2	0.3	1.6
20130718	1355	37.39	40.04	-75.55	0.0	1.8	16	15	123	0.73	0.3	0.3	0.6
20130718	1428	23.78	39.97	-79.39	3.9	2.2	10	23	90	0.59	0.3	0.4	0.8
20130718	1540	24.25	41.00	-75.95	0.0	1.6	9	12	75	0.45	0.3	0.3	99.0
20130718	1628	15.59	40.81	-78.20	0.1	2.1	21	28	40	0.69	0.2	0.2	0.5
20130718	1924	15.99	41.00	-78.48	0.0	1.8	15	18	62	0.62	0.2	0.3	0.9
20130719	1336	32.47	40.85	-78.31	0.0	1.8	10	8	71	0.26	0.3	0.3	99.0
20130719	1346	53.78	41.09	-75.77	0.1	1.8	7	8	108	0.35	0.3	0.4	99.0
20130719	1453	39.1	40.91	-79.03	0.0	1.9	8	15	199	0.35	0.3	1.0	0.8
20130719	1703	22.55	41.12	-78.34	0.4	2.0	12	23	61	0.40	0.3	0.3	2.2
20130719	1709	28.61	40.77	-78.42	0.0	1.8	10	20	70	0.63	0.3	0.3	99.0
20130722	1205	54.54	40.35	-78.80	0.1	1.5	5	22	135	0.31	0.4	0.5	99.0
20130722	1421	48.83	41.11	-76.02	0.0	1.4	6	13	162	0.94	0.4	0.6	99.0
20130722	1432	27.78	40.81	-76.37	0.0	2.0	22	30	75	0.92	0.2	0.2	0.5
20130722	1435	53.26	40.92	-77.63	0.1	1.7	7	22	143	0.99	0.4	0.4	99.0
20130722	1612	20.83	40.84	-78.21	0.1	2.1	27	12	38	0.82	0.2	0.2	0.4
20130723	1402	48.39	41.26	-75.74	0.0	1.6	7	23	126	0.24	0.3	0.4	99.0
20130723	1414	35.35	40.71	-76.31	1.8	1.4	11	37	107	0.40	0.2	0.4	1.3
20130723	1442	34.47	40.82	-78.44	1.8	1.8	13	16	62	0.36	0.2	0.3	0.7
20130723	1515	0.97	40.82	-78.22	0.0	1.8	9	13	98	1.16	0.3	0.3	99.0
20130723	1516	59.71	41.08	-78.33	0.3	2.1	12	18	55	0.46	0.3	0.3	1.0
20130723	1522	58.28	40.64	-78.18	0.0	2.0	21	22	83	0.72	0.2	0.3	0.5
20130723	1532	51.89	41.28	-75.82	0.1	1.6	7	17	106	0.17	0.3	0.4	99.0
20130723	1800	4.33	40.29	-76.56	9.3	1.3	5	15	153	0.03	0.4	1.3	1.8
20130723	1807	42.61	40.90	-78.25	0.4	1.9	13	4	72	0.66	0.2	0.3	0.7

20130723	2054	21.02	40.85	-78.20	0.0	2.1	17	11	60	0.79	0.2	0.2	0.9
20130724	1323	0.18	40.79	-76.39	0.0	1.6	13	29	112	0.74	0.2	0.4	0.9
20130724	1530	57.21	40.88	-79.68	11.2	2.0	6	27	132	0.24	0.4	0.6	1.1
20130725	1244	48.7	40.88	-75.95	0.0	1.4	8	16	108	0.87	0.3	0.5	2.2
20130725	1408	13.84	40.77	-78.53	8.4	2.2	19	26	44	0.83	0.2	0.2	0.5
20130725	1539	10.77	41.12	-78.29	0.0	2.4	31	22	34	0.58	0.2	0.2	0.4
20130726	1256	41.44	40.71	-76.31	1.6	1.5	9	38	104	0.53	0.3	0.5	0.9
20130726	1444	52.78	40.05	-75.53	0.0	1.6	11	15	88	0.47	0.3	0.3	0.9
20130726	1606	57.92	40.79	-78.49	0.0	1.9	16	22	61	0.77	0.2	0.3	0.7
20130726	1640	58.04	41.13	-79.53	3.2	2.3	23	43	102	0.62	0.2	0.3	0.4
20130726	1827	20.76	40.85	-78.23	0.1	2.0	15	10	60	0.57	0.2	0.3	0.6
20130726	2035	7.71	40.51	-79.04	0.0	1.8	6	8	91	0.58	0.4	0.5	2.9
20130729	1303	10.75	40.84	-76.37	0.8	1.8	17	30	72	1.01	0.2	0.3	0.7
20130729	1331	4.65	40.95	-75.90	0.0	1.4	8	11	151	0.44	0.3	0.5	2.0
20130729	1951	50.48	41.09	-78.31	0.0	2.2	8	19	82	0.51	0.3	0.3	99.0
20130730	1724	27.13	40.79	-78.47	0.1	1.9	17	20	59	0.74	0.2	0.3	0.9
20130730	1801	26.65	41.30	-78.66	6.1	2.0	17	20	89	0.75	0.2	0.3	0.5
20130731	1314	2.53	40.85	-75.90	0.1	1.6	8	14	115	0.26	0.3	0.5	2.1
20130731	1427	24.38	40.09	-79.22	3.9	2.2	14	14	91	0.71	0.2	0.3	0.5
20130731	1602	6.3	41.17	-78.81	0.0	2.1	10	6	99	0.73	0.3	0.4	1.0
20130731	1708	18.27	40.66	-78.16	0.0	1.9	18	23	57	0.60	0.2	0.3	0.6
20130731	1711	26.39	41.10	-78.36	0.0	1.9	7	20	92	0.32	0.3	0.4	99.0
20130731	1816	5.92	40.99	-75.96	0.0	2.0	18	13	79	0.61	0.2	0.3	0.6
20130801	1426	0.74	40.94	-78.66	15.4	2.2	8	30	183	0.57	0.3	0.6	2.0
20130801	1536	42.53	41.10	-78.27	0.1	1.8	20	20	55	0.81	0.2	0.2	0.6
20130801	1600	3.19	41.06	-75.97	0.0	1.6	8	9	118	0.45	0.3	0.4	99.0
20130801	1616	9.44	40.87	-78.27	0.0	1.9	13	6	72	0.48	0.3	0.3	0.9
20130801	1634	11.92	40.43	-78.55	0.1	1.9	16	17	112	0.64	0.2	0.3	0.8
20130802	1306	33.62	40.75	-76.13	0.1	1.8	14	35	128	0.70	0.2	0.4	0.9
20130802	1321	31.87	40.47	-78.51	0.1	2.1	9	12	69	0.43	0.3	0.3	1.0
20130802	1341	16.32	40.65	-78.16	0.0	1.7	7	23	125	0.50	0.3	0.5	99.0
20130802	1751	40.18	41.11	-79.51	2.5	1.7	7	44	119	0.21	0.4	0.4	1.0
20130802	1820	36.54	40.74	-78.53	0.0	2.1	7	25	111	0.91	0.3	0.4	99.0
20130805	1340	59.21	40.73	-76.26	0.0	1.4	7	40	113	0.31	0.3	0.5	2.3
20130805	1539	28.23	40.02	-80.03	0.0	2.2	14	33	60	0.41	0.3	0.3	0.6
20130805	1539	52.94	40.76	-76.00	28.1	1.5	7	26	118	0.87	0.4	0.6	0.7
20130805	1747	38.68	40.84	-78.19	0.0	2.0	9	13	102	0.99	0.3	0.3	99.0
20130806	1834	36.03	40.78	-78.53	0.0	1.5	14	25	140	0.66	0.2	0.4	0.6
20130807	1220	44.29	40.78	-76.31	1.0	1.6	9	36	96	0.49	0.3	0.4	1.0
20130807	1328	50.16	41.00	-76.70	0.4	1.7	13	18	138	0.61	0.2	0.5	0.8
20130807	1440	13.13	40.63	-76.31	0.6	1.8	16	37	109	0.79	0.2	0.3	0.7
20130807	1518	33.78	41.08	-78.32	9.6	2.2	8	17	106	0.26	0.3	0.4	0.8
20130807	1525	50	41.13	-78.26	0.6	2.0	27	23	47	0.68	0.2	0.2	0.4
20130807	1702	37.87	40.55	-79.10	0.1	2.2	22	7	78	0.70	0.2	0.3	0.5
20130807	1958	54.62	40.83	-75.88	3.5	1.5	5	13	159	0.10	0.4	0.7	4.1
20130808	1422	44.3	40.88	-78.39	0.0	1.7	6	9	107	0.30	0.3	0.4	99.0
20130808	1641	23.32	40.41	-80.36	0.1	2.2	22	26	62	0.92	0.2	0.3	0.5
20130808	1811	21.71	40.83	-76.12	0.0	2.2	26	31	112	0.74	0.2	0.3	0.5
20130808	1829	48.63	40.86	-78.24	0.0	2.2	25	8	39	0.85	0.2	0.2	0.4
20130808	1856	53.82	41.16	-79.52	8.6	2.4	14	41	102	0.63	0.3	0.4	0.7

20130808	1916	29.92	40.42	-78.59	0.1	1.9	32	17	28	0.86	0.2	0.2	0.4
20130809	1355	24.82	40.71	-76.09	9.7	1.5	10	36	107	0.44	0.3	0.4	1.4
20130809	1558	30.95	40.58	-79.05	0.7	2.1	14	2	75	0.94	0.2	0.3	0.7
20130809	1657	55.75	41.12	-78.30	0.1	1.9	14	22	59	0.91	0.3	0.3	0.7
20130809	2153	40.74	40.94	-79.05	0.2	1.7	17	19	59	0.86	0.2	0.3	0.6
20130812	1449	26.88	40.74	-76.50	1.5	1.8	14	22	79	0.71	0.2	0.3	0.7
20130812	1638	3.94	40.83	-76.09	0.0	1.4	8	29	102	0.25	0.3	0.5	1.1
20130812	1808	23.84	40.80	-78.66	0.0	1.6	6	28	83	0.34	0.4	0.4	99.0
20130812	1812	53.41	41.12	-78.31	0.0	2.1	31	22	58	0.66	0.2	0.2	0.4
20130812	2054	21.86	40.85	-78.25	0.1	2.0	25	9	43	0.63	0.2	0.2	0.4
20130813	1211	57.97	41.09	-79.51	0.1	2.1	11	43	71	0.33	0.3	0.4	0.8
20130813	1355	36.89	40.78	-78.55	0.0	1.9	13	26	74	0.67	0.3	0.3	0.9
20130813	1651	38.01	40.89	-78.26	0.0	1.9	12	4	61	0.62	0.3	0.3	1.0
20130813	1717	27.15	40.08	-75.90	0.0	1.6	12	15	78	0.45	0.3	0.3	1.0
20130813	1808	42.15	41.09	-78.33	2.7	1.8	10	19	98	0.66	0.3	0.4	1.3
20130813	2016	38.47	41.50	-77.35	0.0	2.8	53	28	78	0.74	0.1	0.2	0.3
20130814	1444	55.94	40.79	-78.54	0.1	1.7	8	25	148	0.26	0.3	0.5	99.0
20130814	1637	13.87	40.90	-78.27	0.0	2.2	14	4	64	0.63	0.3	0.3	0.6
20130814	1711	21.88	40.99	-75.89	0.1	2.8	35	11	45	0.82	0.2	0.2	0.4
20130815	1306	7.85	40.85	-78.22	0.1	1.9	16	10	66	0.61	0.2	0.3	0.6
20130815	1615	55.58	40.84	-78.22	0.0	2.1	15	11	73	0.87	0.2	0.3	0.6
20130815	1651	20.67	40.79	-76.69	0.1	2.1	31	6	50	0.56	0.2	0.2	0.4
20130815	1818	42.06	40.55	-79.06	0.1	2.5	26	5	71	0.95	0.2	0.2	0.5
20130815	1844	35.25	40.83	-78.59	0.1	1.3	6	26	153	0.26	0.3	0.5	99.0
20130815	1854	19.85	40.36	-78.81	0.1	2.7	48	23	24	0.77	0.1	0.2	0.3
20130815	2054	22.6	40.79	-78.51	0.0	2.1	10	23	80	0.43	0.2	0.3	99.0
20130816	1302	24.92	40.48	-78.52	4.6	2.1	15	12	70	0.49	0.2	0.3	0.5
20130816	1401	4.61	41.49	-75.81	0.0	1.3	7	8	127	0.12	0.3	0.5	99.0
20130816	1415	37.26	40.47	-78.88	0.0	2.0	11	18	102	0.49	0.2	0.4	0.7
20130816	1518	25.01	40.92	-78.24	0.5	2.1	14	5	52	0.57	0.2	0.3	2.1
20130816	1557	39	39.78	-79.76	1.0	2.2	13	30	91	0.70	0.3	0.4	0.7
20130816	1635	56.21	40.09	-79.25	2.5	2.2	16	14	75	0.44	0.3	0.3	0.5
20130819	1459	1.99	40.94	-75.94	0.1	2.0	17	15	96	0.48	0.2	0.3	0.6
20130819	1646	39.31	41.13	-78.30	0.0	2.1	29	24	60	0.58	0.2	0.2	0.4
20130819	1830	7.01	40.80	-78.67	0.0	1.6	8	27	85	0.23	0.3	0.3	99.0
20130819	1905	33.66	40.86	-78.24	0.0	2.1	18	9	53	0.71	0.2	0.2	0.5
20130820	1312	34.16	40.99	-78.45	0.0	1.7	10	15	133	0.77	0.3	0.5	1.2
20130820	2030	59.01	41.10	-78.29	0.1	1.9	11	20	56	0.60	0.3	0.3	2.3
20130821	1346	27.14	40.98	-78.20	0.0	1.9	16	11	123	0.78	0.2	0.3	0.5
20130821	1442	2.59	41.13	-75.55	0.1	1.5	6	27	166	0.12	0.3	0.6	99.0
20130821	1510	1	41.13	-78.38	4.5	2.0	30	24	37	0.86	0.2	0.2	0.3
20130821	1604	49.46	39.78	-79.81	0.0	2.0	15	30	180	0.72	0.4	0.5	0.6
20130821	1717	39.71	41.16	-79.56	7.9	2.5	27	40	62	0.74	0.2	0.2	0.4
20130822	1346	31.97	40.78	-78.43	0.0	1.7	12	19	118	0.41	0.2	0.4	2.2
20130822	1444	0.73	40.67	-78.19	0.1	1.9	14	24	110	0.61	0.2	0.3	2.1
20130822	1602	53.72	41.10	-78.30	0.0	1.6	6	21	128	0.47	0.3	0.7	3.2
20130822	1612	56.09	40.80	-76.30	0.0	2.0	14	36	98	0.50	0.2	0.3	0.7
20130822	1851	39.2	41.10	-78.33	0.0	1.8	10	20	125	0.51	0.3	0.4	0.9
20130822	2043	16.63	41.12	-78.33	0.0	1.9	9	22	127	0.61	0.3	0.4	99.0
20130823	1405	11.71	40.62	-79.12	0.1	2.2	14	21	53	0.38	0.2	0.3	0.6

20130823	1644	46.53	40.19	-76.01	0.0	1.8	7	20	122	0.35	0.3	0.4	2.3
20130824	507	26.89	40.15	-80.34	0.1	2.2	37	5	38	0.84	0.2	0.2	0.4
20130826	1356	45.88	40.75	-76.15	1.5	1.7	20	37	85	0.71	0.2	0.3	0.5
20130826	1631	30.68	40.77	-76.49	0.7	2.1	18	21	79	0.72	0.2	0.3	0.5
20130827	1311	49.77	40.84	-78.48	3.2	2.1	22	17	55	0.70	0.2	0.2	0.4
20130827	1545	15.92	40.85	-78.24	0.0	2.0	17	9	64	0.65	0.2	0.2	0.5
20130827	1910	27.28	41.50	-77.35	0.1	2.7	56	28	29	0.78	0.1	0.2	0.3
20130827	1941	42.07	40.90	-78.24	0.0	2.0	13	6	65	0.69	0.2	0.3	2.2
20130828	1350	0.53	41.12	-78.34	0.0	2.1	11	23	65	0.72	0.3	0.3	2.4
20130828	1446	31.83	41.15	-78.10	2.3	1.9	19	31	78	0.66	0.2	0.3	0.6
20130828	1456	20.48	41.44	-75.56	0.0	1.5	7	15	99	0.43	0.3	0.4	99.0
20130828	1540	47.76	40.15	-78.72	0.0	1.5	5	15	114	0.70	0.3	0.5	99.0
20130828	1616	22.97	40.47	-78.88	0.0	1.6	6	18	93	0.14	0.3	0.4	99.0
20130828	1832	3.82	40.87	-78.25	0.1	2.0	23	7	60	0.58	0.2	0.2	0.4
20130828	2018	16.8	40.01	-76.09	0.0	1.6	10	20	94	0.50	0.3	0.4	0.8
20130829	1523	12.78	41.49	-77.36	0.0	2.4	41	27	37	0.66	0.2	0.2	0.4
20130829	1629	36.85	40.81	-76.09	1.2	1.8	12	29	125	0.45	0.2	0.4	1.6
20130829	1930	34.83	40.57	-79.06	0.1	2.3	22	3	75	0.68	0.2	0.2	0.4
20130830	1452	7.27	40.55	-78.48	0.0	2.2	6	6	138	0.60	0.3	0.5	99.0
20130830	1648	52.32	40.91	-78.25	0.0	2.1	15	5	106	0.60	0.2	0.3	0.6
20130830	1848	2.87	40.86	-78.21	0.0	2.0	15	10	72	0.59	0.2	0.3	0.9
20130903	1853	12.66	41.45	-77.37	0.5	2.3	33	24	48	0.57	0.2	0.2	0.4
20130904	1619	11.4	40.81	-78.53	0.0	2.2	14	23	68	0.46	0.2	0.3	1.0
20130904	1623	44.94	40.77	-76.26	0.0	2.3	25	39	105	0.73	0.2	0.3	0.5
20130905	1520	13.56	41.11	-78.29	0.0	1.9	7	21	92	0.22	0.3	0.4	99.0
20130905	1640	29.43	41.11	-79.54	0.1	2.4	18	36	93	0.73	0.2	0.3	0.5
20130905	1803	48.02	40.58	-79.04	0.0	2.1	11	0	78	0.65	0.3	0.4	0.9
20130906	1522	5.59	40.89	-79.65	8.1	2.2	10	30	170	0.60	0.3	0.6	0.6
20130906	1936	1.97	41.49	-77.36	0.0	2.7	66	26	25	0.71	0.1	0.1	0.3
20130909	1706	53.05	41.14	-78.01	3.3	2.0	10	34	76	0.68	0.3	0.3	1.2
20130910	1453	46.12	41.07	-78.35	0.0	1.8	10	17	60	0.69	0.3	0.3	2.4
20130910	1637	46.7	40.80	-78.69	0.0	1.7	6	25	90	0.21	0.3	0.4	99.0
20130910	1701	1.28	41.01	-75.96	0.0	1.4	5	11	150	0.32	0.3	0.6	99.0
20130910	1825	14.51	41.11	-79.51	0.0	2.2	14	36	116	0.58	0.3	0.4	0.6
20130910	1919	34.38	41.47	-77.37	0.0	2.5	54	25	22	0.74	0.1	0.2	0.3
20130911	1304	11.46	40.99	-75.84	0.0	1.8	7	10	114	0.42	0.4	0.4	2.5
20130911	1432	48.65	40.33	-78.80	11.9	1.8	5	21	143	0.21	0.5	0.7	3.5
20130911	1508	49.73	40.86	-79.69	9.9	2.2	14	27	140	0.45	0.3	0.5	0.8
20130911	1756	22.36	41.46	-77.37	0.1	2.1	29	24	35	0.71	0.2	0.2	0.5
20130912	1517	16.45	41.09	-78.37	1.0	2.0	11	19	57	0.56	0.3	0.3	1.7
20130912	1624	3.49	40.88	-78.81	0.0	1.9	8	19	81	0.44	0.3	0.4	33.3
20130913	1639	10.31	39.81	-79.94	0.1	2.3	8	19	94	0.24	0.3	0.3	2.3
20130913	1652	49.12	40.88	-79.70	14.2	2.1	10	26	133	0.67	0.4	0.5	0.6
20130913	1829	49.45	40.86	-78.23	0.0	1.9	20	9	43	0.72	0.2	0.2	0.5
20130913	1832	9.04	40.55	-78.50	0.0	2.2	21	8	44	0.57	0.2	0.2	0.5
20130913	1836	50.29	40.95	-78.23	0.0	2.0	12	6	110	0.50	0.3	0.4	0.6
20130913	1850	16.37	41.48	-77.36	0.0	2.6	58	26	28	0.63	0.1	0.1	0.3
20130914	1826	1.51	40.22	-78.74	0.0	1.7	7	16	115	0.34	0.4	0.4	2.3
20130916	1436	33.52	40.08	-79.28	4.8	2.2	17	14	72	0.43	0.2	0.3	0.4
20130916	1546	31.89	40.93	-75.96	0.0	1.4	6	16	124	0.44	0.3	0.5	99.0

20130916	1628	50.29	41.10	-79.52	0.0	2.4	32	37	54	0.59	0.2	0.2	0.4
20130916	1803	9.08	40.81	-76.34	0.0	2.4	20	32	76	0.92	0.2	0.2	0.5
20130916	1853	13.7	41.46	-77.38	0.1	2.5	51	23	30	0.85	0.1	0.2	0.3
20130916	2022	13.99	40.46	-79.17	0.0	2.1	16	18	98	0.72	0.2	0.3	0.6
20130917	1814	54.33	40.91	-78.24	0.0	1.9	9	5	123	0.55	0.3	0.4	99.0
20130917	1856	46.63	41.00	-78.43	0.0	2.3	7	14	188	0.35	0.3	0.6	99.0
20130917	2109	47.05	41.46	-77.36	0.0	2.4	28	25	69	0.74	0.2	0.2	0.4
20130918	1347	28.55	40.61	-76.51	0.0	1.2	5	13	97	0.31	0.4	0.4	99.0
20130918	1846	40.17	40.87	-78.23	0.0	1.9	10	8	70	0.87	0.3	0.3	2.2
20130918	2042	14.92	41.47	-77.36	0.1	2.3	54	26	19	0.60	0.1	0.1	0.3
20130919	1525	57.29	40.97	-78.47	0.0	2.2	12	16	64	0.40	0.3	0.3	1.0
20130920	1436	25.78	39.80	-79.04	0.9	2.2	6	37	100	0.19	0.4	0.4	1.1
20130920	1606	12.45	40.90	-78.24	0.0	2.2	14	5	65	0.63	0.2	0.3	99.0
20130920	1752	45.88	41.47	-77.38	0.1	2.5	59	24	29	0.84	0.1	0.1	0.3
20130923	1607	0.59	40.85	-78.23	0.1	2.1	21	10	59	0.79	0.2	0.2	0.6
20130924	1420	43.08	40.72	-76.28	0.0	1.6	6	30	132	0.45	0.4	0.5	2.7
20130924	1606	22.49	40.60	-79.07	0.0	2.0	16	3	69	0.59	0.2	0.3	0.6
20130924	1638	36.45	40.04	-80.06	0.0	2.5	14	32	63	0.61	0.3	0.3	0.6
20130925	1429	41.08	40.87	-78.23	0.0	2.1	18	8	58	0.83	0.2	0.2	0.8
20130925	2059	47.04	41.48	-77.37	0.0	2.9	75	25	21	0.83	0.1	0.1	0.3
20130927	1316	44.92	41.15	-78.78	0.0	2.1	7	3	95	0.70	0.3	0.4	99.0
20130927	1338	45.06	40.45	-78.49	0.0	1.9	8	12	145	0.33	0.3	0.5	2.6
20130927	1722	5.18	41.47	-77.35	0.0	2.8	70	27	19	0.68	0.1	0.1	0.3
20130930	1245	12.03	41.15	-79.55	13.4	2.2	9	35	106	0.47	0.3	0.5	0.7
20131001	1821	46.75	41.47	-77.38	0.0	2.3	48	25	29	0.67	0.1	0.2	0.3
20131002	1624	43.51	41.07	-78.35	0.0	1.9	11	17	54	0.66	0.3	0.3	2.3
20131002	1638	5.11	40.11	-78.96	1.1	2.0	11	31	224	0.68	0.3	0.8	0.7
20131002	1824	11.28	40.74	-78.38	10.0	1.9	7	21	95	0.29	0.3	0.4	1.8
20131003	1356	54.36	40.69	-76.21	20.4	1.3	5	32	122	0.09	0.5	0.6	5.0
20131003	1600	22.4	40.99	-75.94	0.1	1.7	12	13	105	0.32	0.2	0.4	0.7
20131003	1817	37.04	40.91	-78.26	0.0	1.7	9	4	70	0.78	0.3	0.3	1.0
20131003	1830	44.48	40.08	-79.23	1.3	2.4	14	15	66	0.47	0.2	0.3	0.6
20131003	1911	57.69	41.48	-77.38	0.1	2.7	59	25	22	0.68	0.1	0.1	0.3
20131004	1255	28.45	40.73	-76.10	0.1	1.8	17	35	128	0.52	0.2	0.4	0.6
20131004	1718	44.45	41.47	-77.37	0.0	2.2	42	25	39	0.67	0.1	0.2	0.4
20131004	1737	49.76	40.88	-79.67	5.0	2.0	7	28	131	0.46	0.3	0.6	0.7
20131004	1829	20.14	40.83	-76.12	0.0	1.8	10	32	64	0.54	0.2	0.3	99.0
20131004	1846	50.62	40.87	-78.23	0.0	2.2	20	8	56	0.82	0.2	0.2	0.7
20131004	2046	47.31	40.85	-78.48	0.0	1.8	15	17	81	0.59	0.2	0.3	0.5
20131007	1333	26.2	40.49	-78.90	0.1	1.6	6	15	94	0.19	0.3	0.4	99.0
20131007	1355	48.13	40.74	-76.52	0.0	1.6	12	21	78	0.52	0.2	0.3	1.0
20131007	1428	54.25	40.80	-78.44	4.1	2.1	25	18	73	0.62	0.2	0.3	0.4
20131008	1425	33.41	40.90	-78.25	0.1	2.2	22	5	65	0.72	0.2	0.2	0.5
20131008	1538	47.95	40.81	-78.61	0.1	1.5	6	29	84	0.38	0.4	0.4	99.0
20131008	1550	54.17	41.07	-78.30	0.7	2.1	24	17	53	0.80	0.2	0.2	0.4
20131008	1616	48.55	40.99	-75.97	2.5	1.6	8	14	141	0.31	0.4	0.5	1.7
20131008	1758	27.18	39.84	-77.51	0.0	1.8	8	39	140	0.36	0.4	0.5	0.7
20131008	1901	1.91	40.87	-78.23	0.0	2.3	31	8	42	0.74	0.2	0.2	0.4
20131009	1408	49.43	40.89	-78.39	0.0	1.7	9	8	167	0.59	0.3	0.6	2.2
20131009	1542	28.8	40.74	-76.23	0.0	1.5	6	35	114	0.44	0.3	0.4	99.0

20131010	1231	31.82	40.69	-76.20	2.2	1.4	8	43	145	0.77	0.3	0.5	1.3
20131010	1333	26.14	40.71	-76.15	2.8	1.7	19	38	124	0.50	0.2	0.3	0.6
20131010	1402	24.07	40.73	-76.24	14.4	1.4	5	34	113	0.24	0.5	0.6	8.1
20131010	1547	37.4	40.86	-79.70	15.0	2.2	8	27	103	0.57	0.4	0.5	0.7
20131010	1758	0.89	40.48	-79.26	0.0	1.9	7	22	207	0.47	0.4	0.8	2.2
20131010	1822	46.04	40.86	-78.23	0.0	2.0	21	9	47	0.54	0.2	0.2	0.5
20131011	1431	25.56	40.80	-76.32	0.1	1.6	12	34	94	0.57	0.2	0.3	1.3
20131011	1448	50.89	40.81	-76.62	0.0	1.1	6	9	148	0.16	0.4	0.5	99.0
20131011	1557	46.23	40.82	-78.51	0.1	1.5	7	21	152	0.41	0.3	0.5	99.0
20131011	1559	45.53	39.99	-79.42	0.0	1.6	7	21	126	0.23	0.3	0.5	1.0
20131011	1637	31.49	40.72	-76.21	0.1	1.6	6	35	119	0.10	0.3	0.5	99.0
20131011	1646	24.96	40.99	-78.19	0.0	1.8	8	12	69	0.46	0.3	0.3	99.0
20131011	1716	36.74	40.60	-78.12	0.1	1.8	15	20	90	0.44	0.2	0.3	1.4
20131011	1720	51.11	41.08	-79.93	0.0	2.2	8	14	103	0.96	0.3	0.4	99.0
20131011	1724	44.89	41.13	-79.49	3.7	2.5	7	45	123	0.75	0.3	0.5	1.1
20131014	1303	12.1	40.61	-76.42	0.1	1.3	8	14	92	0.42	0.3	0.4	0.8
20131014	1314	53.75	40.89	-78.38	0.0	1.4	11	8	77	0.46	0.3	0.3	1.7
20131014	1403	15.3	41.14	-76.84	7.8	1.7	6	30	184	0.23	0.4	0.7	1.0
20131014	1418	44.72	40.99	-75.92	0.0	1.5	6	11	125	0.51	0.3	0.4	99.0
20131014	1526	29.14	40.68	-76.25	0.3	1.2	6	29	117	0.24	0.3	0.5	99.0
20131014	1527	47.03	40.71	-76.22	0.1	1.3	5	34	118	0.20	0.3	0.5	99.0
20131014	1556	15.32	41.09	-78.30	0.0	1.9	10	19	123	0.52	0.3	0.4	2.3
20131014	1602	50.57	40.93	-79.11	2.4	2.1	13	19	81	0.61	0.2	0.3	0.7
20131014	1612	18.85	40.87	-78.19	0.0	1.9	8	11	105	0.58	0.3	0.3	99.0
20131014	1630	12.4	40.54	-76.19	1.1	1.2	10	25	141	0.50	0.3	0.4	1.4
20131014	1643	52.05	41.08	-78.30	5.4	1.8	12	17	78	0.70	0.3	0.3	0.9
20131014	1649	48.01	41.10	-78.30	0.0	1.9	6	20	109	0.26	0.3	0.4	99.0
20131014	1909	46.63	41.11	-79.51	0.9	2.3	17	35	56	0.48	0.2	0.3	0.5
20131015	1436	59.9	40.71	-78.57	1.0	1.8	5	23	122	0.40	0.4	0.4	99.0
20131015	1456	57.49	40.89	-78.38	0.0	1.4	7	8	163	0.33	0.3	0.5	99.0
20131015	1501	44.46	41.07	-78.30	0.0	1.9	13	16	53	0.44	0.2	0.3	2.2
20131015	1602	7.04	40.99	-75.95	0.2	1.7	11	13	79	0.47	0.3	0.4	1.8
20131015	1919	41.72	40.80	-78.53	4.4	1.9	12	23	65	0.64	0.2	0.3	1.0
20131016	1443	5.05	40.95	-75.94	0.0	1.6	7	15	120	0.98	0.3	0.4	99.0
20131016	1452	55.95	41.49	-75.40	0.1	1.7	7	6	129	0.34	0.3	0.5	99.0
20131016	1536	53.85	40.45	-80.47	25.1	2.7	17	51	73	0.55	0.3	0.4	0.5
20131016	2011	59.81	40.78	-78.53	0.1	2.1	6	25	140	0.67	0.3	0.5	99.0
20131017	1557	17.54	40.74	-76.50	0.0	2.0	21	22	79	0.57	0.2	0.3	0.5
20131017	1604	8.63	41.00	-75.94	0.0	1.5	10	12	76	0.44	0.3	0.4	2.3
20131017	1627	56.63	40.52	-78.46	0.0	1.7	6	4	123	0.24	0.3	0.5	99.0
20131017	1732	17.35	40.71	-76.22	3.1	1.7	7	33	117	0.38	0.3	0.5	1.6
20131018	1258	42.96	41.18	-78.74	2.1	2.1	15	32	76	1.03	0.2	0.3	0.7
20131018	1427	53.35	40.97	-75.91	0.1	1.5	7	13	117	0.29	0.3	0.5	2.4
20131018	1444	47.05	40.72	-76.21	6.7	1.4	6	35	120	0.19	0.3	0.5	1.6
20131018	1521	34.17	40.80	-78.43	0.0	2.0	8	18	131	0.46	0.3	0.5	2.4
20131018	1811	9.54	40.83	-76.11	0.1	2.1	19	31	115	0.59	0.2	0.3	0.6
20131018	1853	29.09	40.93	-78.22	0.0	1.7	7	7	108	0.59	0.3	0.4	99.0
20131019	1822	6.31	40.16	-78.74	0.1	2.5	6	19	225	0.26	0.4	1.0	99.0
20131021	1353	33.86	40.86	-78.37	0.1	1.4	6	9	144	0.53	0.3	0.5	99.0
20131021	1448	24.01	40.57	-76.52	0.0	1.8	13	8	75	0.53	0.3	0.3	1.0

20131021	1644	18.17	40.81	-76.11	0.0	2.0	19	31	114	0.37	0.2	0.3	0.5
20131022	1622	51.28	41.10	-78.23	0.1	1.9	18	20	52	0.67	0.2	0.2	0.7
20131022	1730	49.85	40.90	-78.25	0.0	2.2	14	5	65	0.95	0.2	0.3	1.5
20131023	1349	2.57	40.78	-76.32	0.0	1.9	8	34	134	0.46	0.3	0.5	0.8
20131023	1413	52.94	40.94	-78.24	0.0	1.7	7	5	110	0.50	0.3	0.4	99.0
20131023	1557	19.2	41.11	-78.29	0.0	1.8	8	21	78	0.59	0.3	0.4	2.4
20131023	1653	40.88	40.92	-78.28	0.0	1.9	8	2	123	0.47	0.3	0.4	99.0
20131023	1841	31.41	39.81	-79.63	1.4	1.7	8	16	143	0.72	0.3	0.5	2.0
20131023	1913	30.1	41.17	-78.03	2.8	2.1	12	36	80	0.79	0.3	0.3	1.2
20131023	2041	59.32	40.50	-79.07	0.0	1.9	8	10	162	0.58	0.3	0.5	1.8
20131024	1633	8.77	40.82	-76.11	0.0	1.9	11	31	117	0.65	0.2	0.4	1.5
20131024	1802	25.37	40.82	-78.54	0.0	1.9	9	23	83	0.40	0.3	0.3	99.0
20131025	1240	49.3	40.81	-76.60	0.1	1.4	6	10	151	0.37	0.3	0.5	99.0
20131025	1541	17.91	40.51	-78.46	0.1	1.7	6	5	124	0.30	0.3	0.5	99.0
20131025	1658	28.33	41.10	-79.50	2.3	2.2	6	36	121	0.30	0.4	0.4	1.0
20131025	1805	47.67	40.85	-78.23	0.0	2.1	7	10	76	0.67	0.3	0.3	99.0
20131028	1338	42.25	40.64	-76.11	13.1	1.9	13	36	146	0.83	0.3	0.5	0.6
20131028	1844	54.85	40.79	-76.49	0.7	1.4	8	20	152	0.44	0.3	0.5	25.4
20131028	1910	58.95	40.93	-78.24	0.0	1.6	6	5	143	0.56	0.3	0.5	33.3
20131029	1319	54.57	40.76	-76.68	0.0	1.5	6	9	98	0.24	0.3	0.4	99.0
20131029	1613	33.7	39.75	-79.75	1.9	2.0	8	23	122	0.46	0.3	0.6	0.9
20131030	1412	1.06	40.93	-75.84	10.5	1.4	8	6	134	0.55	0.4	0.6	0.8
20131030	1537	1.12	40.70	-76.25	2.5	1.5	7	31	121	0.63	0.3	0.5	1.5
20131030	1901	37.72	40.85	-78.28	2.0	1.8	14	8	88	0.85	0.2	0.3	0.8
20131031	1509	53.84	40.73	-76.20	0.7	1.5	4	36	134	0.06	0.4	0.6	99.0
20131031	1721	7.17	40.81	-78.44	0.1	2.1	22	18	74	0.59	0.2	0.3	0.5
20131031	1815	21.98	41.45	-77.39	0.0	2.5	42	23	30	0.76	0.1	0.2	0.4
20131101	1729	33.92	41.06	-78.31	0.1	2.0	7	16	130	0.32	0.3	0.5	99.0
20131101	1837	5.04	40.92	-78.21	1.2	2.1	11	8	109	0.67	0.3	0.3	0.9
20131104	1537	2.74	41.46	-75.53	4.4	1.5	14	12	95	0.66	0.3	0.4	0.6
20131104	1608	53.3	40.82	-78.70	0.0	1.6	6	25	172	0.29	0.3	0.6	99.0
20131104	1614	50.21	41.16	-78.06	0.0	2.1	11	34	75	0.78	0.3	0.3	99.0
20131104	1921	42.06	40.39	-80.30	0.0	2.2	9	24	87	1.02	0.3	0.4	1.0
20131104	1944	40.42	40.82	-76.04	14.5	1.4	7	26	142	0.80	0.5	0.6	0.7
20131105	1358	10.07	40.98	-76.75	14.1	1.8	9	16	76	0.91	0.3	0.4	1.0
20131105	1504	10.86	41.17	-77.02	9.2	1.6	8	22	71	0.79	0.3	0.4	0.7
20131105	1508	25.85	40.92	-78.25	0.0	2.1	10	4	63	0.57	0.3	0.3	99.0
20131105	1910	26.35	41.10	-78.26	0.0	2.0	13	20	74	0.58	0.2	0.3	2.2
20131106	1240	41.42	40.50	-79.03	0.0	1.9	11	9	92	0.72	0.3	0.3	0.7
20131106	1702	40.68	40.91	-78.25	6.2	2.0	10	43	65	0.53	0.3	0.4	1.3
20131106	1716	46.85	40.82	-78.46	0.0	1.6	6	17	148	0.23	0.3	0.5	99.0
20131106	1820	49.5	41.46	-77.37	0.0	2.5	50	25	29	0.69	0.1	0.2	0.3
20131106	2016	39.4	40.87	-78.24	0.1	2.0	7	7	145	0.21	0.3	0.5	99.0
20131106	2022	43.4	40.85	-78.69	2.1	2.2	20	27	101	0.69	0.2	0.3	0.5
20131107	1316	14.04	40.81	-76.40	0.1	1.6	4	27	161	0.27	0.4	0.6	99.0
20131107	1355	57.31	40.72	-76.09	0.0	1.7	10	35	130	0.44	0.2	0.4	1.4
20131107	1615	22.73	40.96	-79.68	10.5	2.3	7	26	133	0.34	0.4	0.5	1.1
20131108	1504	27.03	40.90	-77.65	9.9	1.7	5	21	89	0.00	0.4	0.9	1.9
20131108	1633	17.33	40.79	-78.44	0.0	1.8	7	19	131	0.36	0.3	0.4	2.3
20131108	1911	29.73	41.46	-77.36	0.1	2.7	65	25	19	0.81	0.1	0.1	0.3

20131108	2001	8.59	40.77	-78.65	0.0	2.2	10	29	82	0.70	0.3	0.3	99.0
20131111	1332	21.42	40.73	-76.15	0.2	1.3	4	38	132	0.21	0.4	0.6	99.0
20131111	1451	31.78	40.43	-78.52	1.8	2.2	7	16	125	0.44	0.3	0.5	7.6
20131111	1558	38.66	40.85	-78.27	0.1	2.0	9	8	80	0.58	0.3	0.3	99.0
20131111	1733	10.86	41.13	-79.51	6.3	2.5	8	34	99	0.53	0.3	0.4	1.3
20131112	1607	12.75	40.89	-79.77	29.9	2.0	6	20	110	0.60	0.4	0.9	1.0
20131112	1630	57.12	40.85	-78.21	0.0	2.0	10	11	74	0.74	0.3	0.3	99.0
20131112	1750	17.96	40.82	-78.22	0.0	2.0	8	13	81	0.77	0.3	0.3	99.0
20131112	1937	17.94	41.47	-77.35	0.0	2.8	61	26	19	0.65	0.1	0.1	0.3
20131113	1351	21.69	41.17	-76.89	0.0	1.4	4	25	174	0.13	0.4	0.6	99.0
20131113	1512	35.85	40.72	-76.21	0.3	1.5	4	35	132	0.11	0.4	0.5	99.0
20131113	1617	31.07	41.07	-78.33	0.3	1.9	5	17	104	0.31	0.4	0.4	99.0
20131113	1730	26.41	41.35	-78.68	2.0	1.9	5	14	131	0.07	0.4	0.5	8.2
20131114	1534	3.45	41.44	-75.57	0.0	1.8	8	16	87	0.17	0.3	0.3	99.0
20131114	1704	8.26	40.82	-76.09	0.0	1.8	6	29	121	0.32	0.3	0.4	99.0
20131114	1708	18.07	40.84	-78.22	0.0	2.0	10	11	61	0.58	0.3	0.3	99.0
20131115	1431	26.28	41.48	-75.79	0.1	1.5	6	9	115	0.17	0.3	0.4	99.0
20131115	1655	9.16	40.92	-78.96	0.0	1.7	5	15	174	0.36	0.3	0.7	99.0
20131115	2114	20.93	40.02	-80.00	1.6	1.7	7	30	105	0.63	0.3	0.4	22.5
20131118	1723	54.64	41.08	-78.33	0.0	1.7	7	18	105	0.36	0.3	0.4	99.0
20131119	1530	33.77	40.03	-77.25	11.0	1.7	6	5	203	0.06	0.4	1.3	1.4
20131119	1601	13.57	40.80	-76.29	0.0	1.6	7	36	97	0.51	0.3	0.4	99.0
20131119	1645	25.73	41.47	-77.36	0.0	2.6	62	25	19	0.78	0.1	0.1	0.3
20131119	1710	3.14	40.83	-76.09	0.0	1.7	6	29	119	0.28	0.3	0.4	33.3
20131119	1734	55.44	40.76	-78.44	7.2	1.9	7	21	121	0.92	0.3	0.4	1.3
20131119	1743	50.65	40.95	-79.04	0.0	1.9	8	19	126	0.83	0.2	0.5	99.0
20131119	1844	58.9	41.12	-78.25	0.0	2.0	13	23	74	0.67	0.3	0.3	1.7
20131120	1256	57.49	40.57	-79.18	0.0	1.7	6	13	201	0.52	0.4	0.7	99.0
20131120	1445	12.26	40.70	-76.21	5.8	1.5	9	32	121	0.35	0.3	0.4	1.0
20131120	1602	22.23	40.85	-79.66	8.3	2.2	9	30	137	0.84	0.3	0.5	0.8
20131120	1925	19.5	40.83	-78.21	0.0	1.8	7	13	105	0.78	0.3	0.4	99.0
20131121	1648	19.34	41.47	-77.36	0.1	2.4	55	26	28	0.70	0.1	0.1	0.3
20131121	1808	5.11	40.76	-78.44	10.5	2.1	9	21	122	0.25	0.3	0.4	0.8
20131121	1943	42.25	41.10	-79.14	0.0	1.9	7	27	98	0.83	0.3	0.4	99.0
20131122	1342	4	40.96	-76.69	24.8	1.5	6	14	98	0.26	0.4	0.8	1.7
20131122	1521	3.99	40.73	-76.66	0.2	1.9	19	13	65	0.64	0.2	0.2	0.8
20131122	1618	59.52	40.72	-76.20	10.3	1.6	11	35	69	0.65	0.3	0.3	11.6
20131122	1654	6.31	41.09	-78.32	0.0	2.1	8	19	106	0.45	0.3	0.4	99.0
20131122	1657	27.36	40.49	-77.89	1.7	2.0	21	16	85	0.53	0.2	0.2	0.4
20131122	1719	38.69	40.87	-78.25	0.1	1.7	7	7	84	0.24	0.3	0.4	99.0
20131122	1737	2.89	40.88	-78.26	0.0	2.0	7	6	81	0.71	0.3	0.4	99.0
20131122	1940	32.01	40.81	-78.54	0.6	1.8	5	23	152	0.57	0.4	0.5	99.0
20131122	2034	42.92	40.92	-78.30	0.0	1.7	7	0	122	0.58	0.3	0.4	10.2
20131125	1933	54.72	41.45	-77.37	0.0	2.4	45	24	29	0.74	0.1	0.2	0.4
20131125	2129	16.06	40.70	-78.48	7.3	2.0	11	18	94	0.74	0.3	0.3	0.6
20131126	1535	49.88	40.48	-78.50	0.0	2.0	7	11	122	0.28	0.3	0.4	99.0
20131126	1609	1.98	41.44	-75.53	0.1	1.5	10	14	82	0.69	0.3	0.3	1.8
20131126	1636	0.39	40.80	-76.27	0.0	2.0	9	38	101	0.45	0.3	0.4	0.9
20131126	1713	32.65	40.98	-75.95	0.0	1.6	8	13	80	0.60	0.3	0.3	99.0
20131127	1652	46.55	41.10	-78.37	0.0	2.2	6	21	100	0.19	0.3	0.4	99.0

20131129	1539	49.9	40.97	-75.96	0.0	1.4	9	15	113	0.32	0.3	0.4	1.8
20131129	2101	48.38	40.42	-79.31	0.0	1.6	7	23	139	0.60	0.3	0.4	99.0
20131203	1717	20.62	40.99	-75.93	0.1	1.6	10	12	76	0.57	0.2	0.3	99.0
20131203	1722	26.62	40.84	-76.10	0.2	1.4	5	29	127	0.17	0.3	0.6	99.0
20131203	1722	27.59	41.01	-79.05	0.0	2.1	7	38	87	0.81	0.3	0.4	99.0
20131204	1510	52.79	40.91	-78.18	0.0	1.9	7	10	127	1.16	0.3	0.4	99.0
20131204	1533	46.12	40.72	-76.21	0.2	1.4	5	35	119	0.22	0.3	0.5	99.0
20131204	1718	31.94	40.99	-80.24	3.3	2.2	11	21	120	0.89	0.3	0.4	0.7
20131204	1726	59.77	40.83	-76.12	0.0	1.5	7	31	126	0.22	0.3	0.6	99.0
20131204	1937	48.22	40.84	-78.25	0.1	1.9	10	10	69	0.92	0.3	0.3	1.7
20131205	1320	31.77	40.62	-76.42	0.0	1.9	27	15	65	0.68	0.2	0.2	0.4
20131205	1350	18.69	40.94	-78.23	0.0	1.9	8	7	85	0.69	0.3	0.3	99.0
20131205	1728	32.23	40.98	-78.24	0.0	1.8	10	8	92	0.84	0.3	0.3	2.3
20131205	1811	55.5	41.10	-78.34	0.0	2.0	8	20	104	0.58	0.3	0.3	99.0
20131205	1920	18.96	41.12	-79.91	0.1	2.2	11	19	84	0.26	0.3	0.3	0.7
20131205	1941	5.3	40.83	-76.09	0.0	1.5	5	29	155	0.20	0.3	0.8	99.0
20131206	1329	51.19	40.92	-78.23	0.0	1.8	5	6	133	0.64	0.3	0.5	33.3
20131206	2017	14.46	40.86	-78.43	8.1	1.8	6	13	157	0.29	0.3	0.7	1.0
20131209	1442	20.51	40.93	-78.20	0.0	1.8	6	8	149	0.74	0.4	0.5	99.0
20131209	1846	51.53	40.95	-78.22	0.0	1.9	5	7	219	0.53	0.4	0.9	99.0
20131209	1854	16.85	40.40	-78.52	0.0	1.7	6	15	162	0.26	0.3	0.5	99.0
20131210	1513	41.51	40.80	-76.28	4.0	1.9	20	37	99	0.51	0.2	0.2	0.5
20131210	1741	47.73	41.01	-75.95	0.1	1.2	5	11	149	0.40	0.3	0.6	99.0
20131211	1546	54.94	40.87	-78.68	12.1	1.7	5	28	190	0.39	0.4	1.7	7.6
20131212	1359	59.46	40.75	-76.08	10.2	1.4	6	32	136	0.16	0.4	0.7	15.1
20131213	1640	2.16	40.73	-76.21	17.3	1.6	8	35	117	0.58	0.3	0.5	1.2
20131213	1715	49.78	41.09	-78.35	0.0	1.9	7	19	159	0.38	0.3	0.5	99.0
20131213	1727	58.6	40.97	-78.92	7.1	2.0	8	21	69	0.79	0.3	0.4	0.7
20131213	1806	40.73	40.97	-75.94	0.0	1.8	9	14	110	0.48	0.3	0.4	99.0
20131213	1934	9.53	40.82	-78.54	0.0	2.0	8	23	82	0.58	0.3	0.3	99.0
20131216	1735	12.55	40.85	-80.00	26.4	2.2	6	12	128	0.91	0.4	0.5	1.1
20131217	1814	49.13	40.99	-75.96	0.0	1.7	10	13	78	0.49	0.2	0.3	99.0
20131218	1503	58.32	41.27	-76.92	10.6	1.3	5	14	112	0.78	0.4	0.6	1.8
20131218	1620	11.28	40.51	-77.88	0.0	2.2	20	37	56	0.62	0.2	0.3	0.5
20131218	2039	22.54	40.82	-78.51	0.0	2.0	6	21	155	0.66	0.3	0.5	99.0
20131219	1528	2.53	41.45	-75.59	0.0	1.9	10	16	87	0.39	0.3	0.4	0.9
20131219	1631	27.88	40.77	-76.27	0.0	2.2	11	36	144	0.60	0.3	0.4	1.6
20131219	1712	8.46	40.80	-78.52	0.7	1.9	6	23	148	0.32	0.3	0.5	99.0
20131219	1755	22.74	41.10	-78.25	0.0	1.7	8	20	107	0.42	0.3	0.4	2.2
20131220	1415	11.55	40.63	-76.31	0.5	1.9	15	22	103	0.79	0.2	0.3	0.8
20131220	1844	23.91	40.78	-78.45	0.0	2.2	16	20	72	0.71	0.2	0.3	0.9
20131223	1915	22.73	40.84	-78.25	0.0	2.0	15	10	68	0.75	0.2	0.3	1.2
20131223	1934	40.67	40.43	-78.53	0.1	1.5	5	16	149	0.13	0.3	0.5	99.0
20131224	1521	54.22	40.82	-76.26	10.9	1.7	5	39	134	0.08	0.3	0.9	21.3
20131224	1705	53.06	40.82	-78.44	2.6	2.1	14	17	73	0.45	0.2	0.3	0.6
20131226	1614	29	40.47	-78.92	0.0	2.1	10	16	88	0.24	0.3	0.3	0.9
20131226	1800	51.73	40.81	-78.45	0.1	1.8	8	18	139	0.52	0.3	0.5	1.1
20131227	1625	24.53	41.12	-78.32	1.2	2.0	11	23	109	0.85	0.3	0.3	1.7
20131227	1707	15.64	40.88	-78.30	0.0	1.9	11	4	70	0.83	0.3	0.3	1.7
20131227	1821	0.64	39.74	-79.73	6.5	2.0	6	23	118	0.38	0.3	0.6	0.9

20131230	1434	10.54	40.91	-78.21	0.0	1.9	7	8	92	0.59	0.3	0.4	99.0
20131230	1732	11.61	40.86	-78.45	29.0	2.2	7	14	165	0.62	0.4	0.8	0.7
20131230	1741	35.32	41.10	-79.50	12.1	2.3	9	36	121	0.70	0.3	0.4	0.8
20131231	1341	6.4	40.73	-76.16	5.1	1.3	9	39	126	0.40	0.2	0.5	1.0
20131231	1634	18.79	41.12	-78.31	0.0	1.9	6	22	109	0.75	0.4	0.4	99.0
20140102	1531	23.51	40.77	-76.26	1.3	2.0	15	36	106	0.41	0.3	0.3	0.5
20140102	1712	55.88	40.86	-78.24	0.0	2.2	6	38	166	0.37	0.4	0.8	3.4
20140102	1953	48.04	40.96	-78.25	8.2	1.9	5	48	147	0.45	0.4	0.6	1.7
20140103	1821	32.96	41.13	-79.49	9.8	2.6	8	44	94	0.20	0.3	0.4	1.3
20140103	1945	54.63	40.90	-78.26	0.4	2.2	7	4	196	0.16	0.4	0.8	0.7
20140104	1923	41.94	40.19	-78.74	0.0	1.6	6	17	122	0.55	0.4	0.4	99.0
20140106	1525	19.78	40.75	-76.17	0.0	1.7	9	39	162	0.35	0.3	0.6	0.8
20140106	1538	28.2	41.12	-78.35	0.0	1.9	8	22	144	0.58	0.3	0.6	0.9
20140106	1941	35.77	40.82	-78.68	1.6	2.2	11	26	81	0.40	0.3	0.4	0.6
20140108	1745	30.07	40.86	-78.23	0.0	1.8	11	9	83	0.39	0.3	0.3	0.7
20140108	1851	13.62	40.51	-77.91	0.0	1.4	4	39	165	0.28	0.4	0.6	99.0
20140108	2010	38.16	40.82	-78.66	0.7	2.3	14	28	86	0.50	0.3	0.3	0.5
20140109	202	38.26	39.91	-76.30	5.8	1.5	7	15	129	0.24	0.4	0.4	1.2
20140109	1633	28.31	40.89	-78.23	0.1	2.2	6	42	163	0.47	0.3	0.8	1.0
20140109	1644	51.89	40.10	-80.40	0.0	2.4	7	24	207	0.61	0.4	1.4	5.2
20140109	1837	26.92	41.08	-78.34	0.0	2.1	11	19	56	0.37	0.3	0.3	2.2
20140109	1935	32.72	40.84	-78.63	0.1	2.1	8	30	124	0.40	0.3	0.4	2.3
20140110	1525	4.26	41.44	-75.58	0.1	2.0	15	17	71	0.52	0.2	0.3	0.7
20140110	1714	1.46	41.11	-78.34	0.0	2.0	12	21	64	0.62	0.2	0.3	1.7
20140110	1754	53.47	40.94	-78.96	0.1	1.7	7	18	135	0.33	0.3	0.6	99.0
20140110	1804	2.18	40.89	-78.25	0.0	2.0	15	6	58	0.71	0.2	0.3	0.7
20140110	2010	40.76	40.83	-78.67	0.6	2.2	15	28	80	0.54	0.2	0.3	0.5
20140113	1511	21.53	40.87	-78.28	3.9	1.9	12	39	68	0.36	0.2	0.3	0.6
20140113	1614	35.34	41.11	-78.33	0.0	2.1	11	22	70	0.49	0.3	0.3	0.7
20140113	1731	49.51	39.99	-76.08	0.1	1.7	6	22	97	0.21	0.3	0.4	99.0
20140113	2106	52.23	40.47	-77.89	0.0	1.8	8	36	80	0.41	0.3	0.3	1.6
20140114	1517	31.83	41.16	-76.05	0.0	1.6	9	16	111	0.38	0.3	0.4	2.0
20140114	1654	50.15	40.80	-78.56	0.0	1.6	7	25	145	0.35	0.3	0.5	99.0
20140114	1840	46.44	40.93	-78.25	0.1	2.3	12	45	70	0.48	0.3	0.4	0.6
20140114	2024	1.26	41.10	-79.51	0.0	2.4	9	36	95	0.37	0.3	0.4	0.8
20140115	1350	35.17	40.75	-76.08	9.4	1.5	5	32	138	0.11	0.4	0.6	1.3
20140115	1512	34.53	40.77	-76.30	0.0	1.9	9	35	100	0.62	0.3	0.3	1.6
20140116	1408	46.88	40.67	-76.10	2.8	1.8	12	38	131	0.65	0.2	0.4	0.6
20140116	1708	11.45	41.44	-77.35	0.0	1.8	10	25	144	0.68	0.3	0.4	0.7
20140116	1749	59.16	40.84	-78.24	0.0	1.7	8	11	104	0.68	0.3	0.4	1.6
20140116	1826	30.08	41.13	-78.30	0.0	2.4	6	24	166	0.52	0.3	0.5	99.0
20140116	1839	14.25	39.74	-77.48	0.1	1.9	4	32	108	0.19	0.4	0.5	99.0
20140117	1409	58.42	40.86	-78.24	0.1	2.1	11	8	64	0.42	0.3	0.3	0.7
20140117	1529	58.7	40.72	-76.21	1.0	1.8	12	35	119	0.37	0.2	0.4	0.7
20140117	1637	45.34	40.60	-76.51	0.0	2.0	9	11	93	0.37	0.3	0.4	0.6
20140117	1754	16.91	40.88	-80.30	0.4	2.2	5	28	112	0.24	0.4	0.8	1.7
20140117	2022	41.89	41.46	-77.36	0.0	2.6	44	25	29	0.53	0.1	0.2	0.3
20140120	1541	11.97	40.73	-76.23	7.8	1.6	6	34	115	0.20	0.3	0.5	1.5
20140120	1602	45.92	41.14	-80.07	5.9	1.9	6	21	189	0.57	0.4	0.7	0.7
20140120	1709	48.66	40.86	-76.11	0.1	1.4	5	30	133	0.29	0.3	0.6	99.0

20140120	1753	48.98	40.57	-78.47	0.0	2.1	9	6	115	0.48	0.3	0.4	1.0
20140120	2032	2.19	41.47	-77.37	0.0	2.6	56	25	26	0.72	0.1	0.1	0.3
20140120	2104	38.09	40.45	-78.10	0.0	2.3	6	44	130	0.82	0.4	0.7	1.1
20140121	1445	48.15	40.79	-76.30	0.0	2.0	12	36	98	0.40	0.2	0.3	0.9
20140121	1624	47.74	40.47	-79.22	1.8	1.8	10	20	183	0.41	0.3	0.6	0.7
20140121	1656	32.12	41.01	-75.94	0.1	1.1	5	10	89	0.37	0.4	0.4	99.0
20140121	1755	13.57	41.11	-79.52	0.3	2.4	7	43	98	0.17	0.4	0.5	0.8
20140121	1801	31.31	40.77	-78.38	0.0	2.1	7	18	142	0.49	0.3	0.6	1.0
20140123	1509	16.61	41.14	-78.30	0.0	2.5	15	25	62	0.55	0.3	0.3	0.5
20140123	1655	15.81	40.49	-79.25	7.5	1.6	7	21	206	0.44	0.4	0.8	0.7
20140123	1657	15.57	39.83	-79.94	0.0	2.4	11	21	77	0.44	0.3	0.3	0.7
20140123	1726	9.14	40.94	-79.02	0.0	1.6	7	18	143	0.68	0.3	0.6	99.0
20140124	1517	15.76	40.91	-78.22	0.0	1.9	5	43	158	0.35	0.4	0.8	1.0
20140124	1544	40.95	40.72	-76.24	4.1	1.7	8	33	111	0.51	0.3	0.5	0.8
20140124	1632	4.99	41.14	-79.37	0.0	1.7	5	25	108	0.40	0.4	0.4	99.0
20140124	1646	54	41.10	-78.28	0.0	1.8	9	20	76	0.68	0.3	0.3	2.3
20140124	1708	43.53	40.99	-75.95	0.0	1.7	6	13	140	0.36	0.3	0.5	99.0
20140124	1835	46.06	40.46	-77.85	0.0	2.3	12	33	80	0.39	0.2	0.4	0.7
20140124	1917	0.37	41.46	-77.36	0.0	2.4	45	25	36	0.55	0.1	0.2	0.3
20140127	1401	45.98	41.29	-75.91	0.0	1.3	5	23	243	0.23	0.4	5.0	1.4
20140127	1458	13.27	40.90	-78.27	0.0	1.7	6	41	126	0.34	0.3	0.7	2.8
20140127	1715	52.84	41.32	-78.73	0.1	2.0	5	17	169	0.26	0.4	0.7	1.2
20140127	1721	45.19	41.10	-78.29	0.1	1.9	5	20	120	0.34	0.3	0.5	99.0
20140127	1730	8.16	41.26	-78.77	0.0	2.1	10	23	72	0.30	0.3	0.3	0.7
20140127	1826	2.53	41.46	-77.37	0.0	2.4	27	25	38	0.51	0.2	0.2	0.5
20140127	2008	49.11	40.76	-78.41	0.0	2.0	6	24	112	0.23	0.3	0.4	99.0
20140128	1519	37.84	40.74	-76.24	0.1	1.5	6	35	114	0.15	0.3	0.5	99.0
20140128	1523	39.91	40.80	-76.32	0.0	1.8	9	34	95	0.44	0.3	0.4	0.9
20140128	2039	45.66	40.85	-78.44	0.1	1.7	9	14	154	0.55	0.3	0.5	1.0
20140129	1528	5.49	41.45	-75.53	0.0	1.8	8	13	88	0.70	0.3	0.4	2.3
20140129	1932	23.65	40.94	-78.23	3.6	1.6	5	7	218	0.09	0.4	1.2	1.9
20140130	2039	38.37	40.84	-78.39	0.1	1.8	5	33	168	0.42	0.4	0.6	99.0
20140131	2014	11.49	41.46	-77.36	2.5	2.5	15	25	133	0.49	0.2	0.4	0.6
20140201	1439	13.83	40.19	-78.75	3.0	1.9	11	18	123	0.48	0.3	0.4	0.7
20140203	1458	2.69	41.45	-75.57	0.0	1.7	7	16	88	0.26	0.3	0.4	99.0
20140203	1755	52.12	40.75	-78.43	0.5	2.4	16	22	77	0.40	0.2	0.3	0.5
20140203	1808	3.53	40.97	-77.96	0.0	2.0	4	44	240	0.23	0.7	4.4	4.6
20140203	1820	1.42	41.49	-77.37	0.1	2.6	48	42	26	0.58	0.1	0.2	0.3
20140203	2024	44.45	40.88	-78.26	0.0	1.8	8	6	93	0.60	0.3	0.4	2.4
20140204	1624	19.55	40.73	-76.14	0.0	1.7	9	38	169	0.43	0.3	0.7	0.8
20140204	1638	3.38	40.46	-77.85	1.8	2.5	7	56	106	0.21	0.3	0.7	1.3
20140204	1735	15.06	41.48	-77.37	1.8	2.2	36	25	28	0.56	0.2	0.2	0.4
20140204	1755	39.45	41.18	-79.65	6.3	2.2	7	36	129	0.30	0.4	0.7	0.8
20140204	1839	37.03	41.12	-78.35	0.0	1.9	10	22	107	0.58	0.3	0.4	1.0
20140204	1843	39.73	40.73	-76.22	0.8	1.5	4	35	134	0.04	0.4	0.5	99.0
20140204	1935	42.16	40.22	-78.91	1.4	1.9	9	31	87	0.52	0.3	0.4	0.7
20140204	1943	34.94	40.86	-78.25	0.1	1.7	10	8	81	0.46	0.3	0.4	0.7
20140204	2010	48.76	40.91	-78.28	0.0	1.6	6	2	84	0.60	0.3	0.4	99.0
20140205	1649	12.66	41.30	-78.72	0.0	1.8	5	19	122	0.34	0.4	0.4	99.0
20140205	1657	3.83	40.76	-78.38	0.0	2.1	7	19	103	0.37	0.3	0.5	1.0

20140205	1927	3.55	40.53	-78.44	0.0	2.3	12	3	86	0.49	0.2	0.3	0.7
20140206	1451	55.3	40.89	-78.25	1.1	2.0	11	5	75	0.69	0.3	0.3	0.7
20140206	1659	13.66	41.13	-78.28	0.0	1.7	7	23	124	0.63	0.3	0.4	99.0
20140206	1714	39.91	40.97	-75.95	0.0	1.7	8	14	145	0.25	0.3	0.5	2.6
20140206	1758	5.35	41.13	-78.33	0.0	2.2	11	23	65	0.64	0.3	0.3	0.9
20140206	1817	30.1	40.95	-78.46	0.0	1.8	6	14	135	0.48	0.4	0.5	1.1
20140206	1847	36.62	41.46	-77.36	0.0	2.3	41	25	28	0.47	0.1	0.2	0.4
20140207	1535	15.02	41.16	-78.09	0.0	2.0	9	32	77	0.75	0.3	0.4	1.6
20140207	2142	8.54	40.96	-78.50	5.6	2.1	7	46	139	0.28	0.3	0.6	0.7
20140209	2234	4.23	41.47	-80.37	4.3	2.0	20	19	94	0.23	0.2	0.3	0.4
20140210	1602	0.23	40.86	-76.30	7.1	2.4	7	59	220	0.29	0.4	1.3	1.1
20140211	1531	50.55	40.49	-78.90	0.1	1.8	6	16	96	0.22	0.3	0.4	99.0
20140211	1617	2.71	41.43	-75.55	0.2	1.7	16	16	85	0.69	0.2	0.3	0.8
20140211	1754	39.31	41.12	-78.33	0.0	2.1	6	22	94	0.59	0.3	0.6	3.2
20140211	1802	23.78	41.15	-79.26	2.8	1.5	6	21	94	0.11	0.3	0.5	2.0
20140211	1804	33.65	41.15	-78.12	0.0	2.0	8	29	94	0.80	0.3	0.4	2.2
20140211	1826	33.28	40.17	-78.88	0.0	1.6	7	26	101	0.69	0.3	0.4	99.0
20140212	1348	47.89	40.75	-76.07	10.0	1.4	5	32	139	0.27	0.4	0.7	25.1
20140212	1759	16.56	40.18	-79.51	0.5	1.9	7	18	223	0.47	0.3	1.5	0.8
20140212	1831	22.05	39.83	-79.93	0.0	2.2	6	26	105	0.17	0.3	0.4	99.0
20140212	1950	12.22	40.89	-78.24	0.0	1.9	8	6	66	0.56	0.3	0.4	2.4
20140213	1941	59.18	40.36	-78.77	1.1	2.2	6	20	88	0.19	0.4	0.4	30.1
20140214	1722	22.78	40.91	-79.02	0.0	2.2	5	14	169	0.39	0.4	0.8	1.2
20140214	1848	59.94	40.79	-78.52	0.0	1.9	5	23	145	0.45	0.4	0.5	99.0
20140214	1952	22.47	41.08	-78.33	4.1	2.2	10	18	67	0.49	0.3	0.4	1.2
20140214	2042	23.03	40.85	-78.25	0.0	2.1	11	33	101	0.60	0.2	0.4	1.0
20140217	1515	54.78	40.73	-76.33	0.0	2.0	6	35	226	0.36	0.3	1.2	1.1
20140217	1751	48.68	41.11	-78.29	0.0	2.1	7	21	80	0.66	0.3	0.4	2.7
20140219	1542	41.61	40.82	-76.39	0.0	1.5	6	28	86	0.48	0.3	0.4	99.0
20140219	1715	25.34	40.85	-78.25	0.0	2.2	9	9	67	0.61	0.3	0.4	0.8
20140219	1822	53.57	40.60	-79.09	0.0	2.0	8	21	103	0.56	0.3	0.4	1.0
20140220	1659	6.01	41.09	-78.40	0.0	1.5	6	21	169	0.61	0.3	0.8	2.6
20140220	1811	3.76	40.63	-78.80	11.9	2.0	7	20	101	0.54	0.4	0.6	1.0
20140220	1815	3.63	40.98	-79.68	0.0	1.7	5	26	161	0.10	0.4	1.2	2.0
20140220	2033	59.14	41.09	-78.30	0.1	2.2	9	19	97	0.47	0.3	0.4	0.8
20140221	1410	0	40.77	-76.31	0.1	2.1	11	34	139	0.49	0.2	0.5	0.7
20140221	1646	4.45	41.29	-78.68	0.0	1.9	5	19	135	0.39	0.3	0.5	99.0
20140221	1718	48.44	41.10	-78.35	0.1	2.4	20	21	59	0.53	0.2	0.2	0.5
20140224	1521	37.41	40.45	-78.46	0.1	2.0	7	11	174	0.29	0.3	0.6	0.8
20140225	1548	13.24	40.65	-78.41	5.6	2.3	13	12	95	0.47	0.2	0.3	0.6
20140225	1558	3.82	41.44	-75.53	0.0	1.8	8	14	81	0.74	0.3	0.3	99.0
20140225	1616	49.95	41.13	-78.06	2.6	2.0	9	31	82	0.41	0.3	0.4	0.7
20140225	1939	58.68	40.83	-78.23	0.0	2.0	7	11	103	0.68	0.3	0.4	2.6
20140226	1506	18.51	40.83	-78.67	0.1	1.8	6	27	175	0.41	0.4	0.6	2.5
20140226	1702	27.42	41.19	-77.00	9.0	1.7	5	20	83	0.81	0.4	0.7	1.6
20140226	1725	24.64	41.63	-77.29	2.3	1.8	5	36	115	0.09	0.4	0.5	1.0
20140227	1714	51.06	40.86	-78.28	0.0	1.8	6	7	129	0.57	0.3	0.8	3.9
20140228	1920	6.65	40.81	-78.67	0.0	2.2	10	27	126	0.51	0.3	0.4	0.7
20140228	1949	36.07	41.05	-79.54	0.1	2.3	6	39	132	0.21	0.4	0.5	0.9
20140228	2007	20.27	40.80	-78.43	0.0	2.1	8	17	107	0.46	0.3	0.4	1.2

20140228	2035	5.32	41.07	-78.35	0.0	2.2	5	17	87	0.46	0.4	0.6	3.1
20140303	1450	6.23	40.69	-78.50	0.1	2.4	12	30	94	0.19	0.3	0.4	0.6
20140303	1714	14.3	40.86	-78.25	0.1	1.8	11	8	99	0.43	0.3	0.3	0.7
20140303	1933	38.96	40.85	-78.68	0.0	2.0	5	27	181	0.27	0.4	0.6	99.0
20140304	1436	53.45	41.15	-76.06	0.0	1.4	7	18	105	0.23	0.3	0.5	1.1
20140304	1728	0.39	40.37	-78.77	0.1	1.4	6	21	87	0.12	0.3	0.4	99.0
20140304	1927	26.79	40.83	-78.44	5.5	2.1	11	16	122	0.44	0.3	0.4	0.5
20140304	1952	23.22	40.81	-78.67	0.1	1.9	8	27	86	0.42	0.3	0.4	2.4
20140305	618	9.08	39.98	-80.46	0.0	1.9	12	11	82	0.35	0.3	0.4	0.8
20140305	1509	30.12	40.80	-76.30	0.7	2.0	14	36	98	0.38	0.3	0.3	0.6
20140305	1656	48.49	40.38	-78.76	2.6	1.7	6	21	85	0.18	0.4	0.5	12.7
20140306	1823	38.26	40.81	-78.67	0.1	2.0	5	28	165	0.23	0.4	0.6	99.0
20140307	1536	32.45	41.15	-77.00	0.1	1.6	6	24	79	0.35	0.4	0.4	2.5
20140307	1631	30.95	40.74	-76.29	0.0	1.7	8	32	105	0.50	0.3	0.5	1.0
20140307	1846	10.7	41.09	-79.53	0.0	2.5	6	38	107	0.56	0.3	0.4	99.0
20140307	1925	32.33	40.83	-78.66	0.1	1.9	5	29	174	0.27	0.4	0.6	99.0
20140311	1315	56.57	41.00	-76.71	0.0	1.6	5	17	110	0.38	0.4	0.6	3.1
20140311	1816	5.06	41.33	-78.73	0.0	2.2	9	16	79	0.40	0.3	0.4	1.0
20140312	1324	19.54	40.12	-79.00	0.0	1.8	6	28	186	0.47	0.4	1.3	1.1
20140312	1433	13.04	40.90	-78.20	0.0	1.7	5	9	215	0.78	0.4	1.0	33.3
20140312	1719	32.17	40.21	-78.99	0.0	1.8	5	26	191	0.66	0.3	0.8	1.8
20140313	1317	52.19	40.74	-76.15	0.0	1.8	10	38	122	0.50	0.3	0.4	0.8
20140313	1932	24.89	41.07	-78.28	0.0	2.1	5	17	132	0.51	0.4	0.6	2.8
20140314	1404	5.86	40.91	-78.27	0.0	1.6	6	2	148	0.64	0.4	0.5	33.3
20140314	1620	35.61	40.90	-78.24	0.0	1.6	6	6	171	0.33	0.3	0.5	99.0
20140314	1638	20.85	41.46	-77.38	0.1	2.5	30	31	36	0.55	0.2	0.2	0.4
20140314	1725	6.59	40.18	-78.22	6.4	1.4	5	31	116	0.11	0.3	0.9	1.2
20140314	1749	40.85	40.52	-78.45	0.0	1.7	7	4	120	0.54	0.3	0.5	1.0
20140317	1500	1.87	41.42	-75.55	0.9	2.2	14	17	87	0.69	0.2	0.3	0.6
20140317	1602	6.54	40.76	-76.30	0.0	2.2	13	36	142	0.38	0.2	0.4	0.7
20140317	1649	38.34	40.79	-78.43	0.0	2.2	9	18	81	0.34	0.3	0.4	0.8
20140318	1530	31.8	41.45	-77.36	0.1	2.5	33	30	45	0.59	0.2	0.2	0.4
20140318	2121	11.19	39.96	-79.36	0.9	2.5	18	25	80	0.50	0.2	0.3	0.4
20140319	1724	26.14	41.04	-78.35	0.0	1.8	7	14	77	0.23	0.3	0.4	2.5
20140319	1850	10.28	41.13	-79.54	6.9	2.3	6	35	103	0.14	0.3	0.8	1.0
20140320	1713	10.58	39.80	-77.24	0.0	1.6	7	27	152	0.21	0.3	0.5	99.0
20140320	1737	11.85	39.80	-77.22	0.0	1.4	9	35	146	0.28	0.3	0.4	0.6
20140321	1759	6.46	41.44	-77.39	0.1	2.2	44	22	34	0.72	0.1	0.2	0.3
20140322	1414	7.9	40.87	-78.27	0.0	2.1	28	6	41	0.45	0.2	0.2	0.4
20140322	1812	46.64	40.87	-78.13	0.1	1.9	6	44	184	0.21	0.3	0.7	1.7
20140324	1753	51.98	41.45	-77.38	0.0	1.9	12	23	81	0.64	0.3	0.3	0.9
20140325	1230	19.03	41.01	-76.73	0.0	1.7	7	18	104	0.38	0.3	0.4	0.9
20140325	1413	51.44	41.16	-76.07	0.1	1.5	11	17	93	0.36	0.3	0.3	0.8
20140325	1453	36.8	40.46	-78.47	2.1	1.9	6	11	152	0.25	0.3	0.5	1.7
20140325	1537	50.25	41.06	-78.33	0.0	2.1	7	16	81	0.56	0.3	0.4	2.4
20140325	1802	12.16	40.43	-78.57	0.0	1.9	14	18	76	0.65	0.2	0.4	0.7
20140326	1220	16.59	40.68	-76.12	2.1	1.3	14	38	102	0.37	0.2	0.4	0.6
20140327	1610	11.85	39.82	-79.93	1.1	2.1	9	27	78	0.20	0.3	0.4	0.8
20140327	1642	3.75	41.33	-78.73	0.0	2.4	12	16	147	0.31	0.2	0.4	0.7
20140328	1501	4.27	41.37	-75.51	5.7	2.1	13	20	100	0.80	0.2	0.4	0.6

20140328	1628	53.43	41.10	-78.33	0.0	2.1	6	20	100	0.55	0.3	0.5	2.5
20140328	1846	55.54	40.80	-78.46	0.0	1.8	5	19	139	0.11	0.4	0.5	99.0
20140331	1440	10.08	40.46	-78.46	0.0	1.9	6	11	147	0.34	0.3	0.6	3.0
20140331	1607	50.19	41.27	-75.74	0.1	1.8	6	24	124	0.24	0.3	0.4	99.0
20140402	1416	50.28	40.79	-78.45	0.0	2.1	8	19	98	0.46	0.3	0.4	1.0
20140402	1515	39.39	40.11	-77.23	0.0	2.0	5	11	158	0.49	0.4	0.7	2.4
20140402	1747	54.52	41.08	-78.26	5.2	2.2	10	18	115	0.49	0.3	0.3	0.6
20140402	1808	16.6	40.86	-78.22	0.0	2.0	6	10	149	0.71	0.3	0.5	1.0
20140403	1215	54.06	40.71	-76.13	1.4	1.8	10	39	138	0.45	0.3	0.4	1.6
20140403	1419	35.61	40.13	-79.49	0.0	1.6	6	18	140	0.77	0.3	1.5	6.3
20140403	1634	41.62	40.47	-77.91	0.0	2.1	9	37	91	0.73	0.3	0.5	0.9
20140403	2105	5.75	40.86	-78.25	0.0	2.0	10	38	97	0.66	0.3	0.5	1.3
20140407	1446	35.49	40.78	-76.29	2.0	2.1	9	36	124	0.56	0.3	0.4	0.9
20140407	1654	23.33	40.86	-76.18	5.8	1.9	8	36	133	0.45	0.3	0.6	0.8
20140407	2015	20.48	39.81	-77.22	0.0	1.6	9	26	146	0.31	0.3	0.5	1.1
20140408	1634	22.76	40.79	-76.73	0.0	2.2	10	5	118	0.31	0.2	0.4	0.9
20140410	1305	30.45	40.73	-76.08	5.6	1.6	7	43	168	0.37	0.4	0.6	1.3
20140410	2051	48.6	40.85	-78.67	0.0	2.1	8	28	179	0.64	0.4	0.5	0.8
20140411	1433	14.76	40.63	-78.30	0.0	2.2	8	14	130	0.74	0.4	0.5	1.1
20140414	1337	0.38	40.73	-76.07	4.2	1.5	7	43	165	0.46	0.3	0.6	0.8
20140414	1515	53.63	40.91	-78.27	0.0	1.9	6	3	135	0.81	0.4	0.6	3.1
20140414	1854	53.22	41.45	-77.36	0.1	2.3	16	24	57	0.51	0.2	0.3	0.5
20140416	1539	57.22	40.98	-75.94	0.1	1.9	5	13	93	0.48	0.4	0.4	99.0
20140416	1750	26.47	39.90	-77.53	1.9	2.2	6	36	123	0.15	0.3	0.5	1.0
20140417	1402	19.56	40.91	-78.22	0.0	2.1	4	7	238	0.69	0.5	1.2	99.0
20140417	1601	3.09	40.12	-77.39	0.2	1.5	4	12	153	0.03	0.4	0.6	99.0
20140417	1716	10.15	40.71	-76.20	0.0	2.3	7	43	214	0.88	0.3	0.9	99.0
20140418	1403	41.14	40.50	-78.45	6.7	2.1	5	28	182	0.17	0.4	1.4	1.1
20140418	1606	46.37	41.06	-78.14	0.0	2.0	6	54	211	0.47	0.3	1.1	2.4
20140421	1319	15.78	40.88	-78.21	0.8	2.0	9	41	100	0.46	0.3	0.3	0.9
20140424	1418	43.77	40.63	-76.40	1.2	1.8	7	40	115	0.28	0.3	0.4	1.7
20140424	1739	37.29	41.45	-77.37	0.0	2.5	27	24	49	0.54	0.2	0.2	0.4
20140424	2129	42.11	41.05	-78.34	3.6	2.3	6	15	152	0.37	0.4	0.5	0.8
20140425	1347	37.05	40.92	-78.26	0.0	2.1	11	3	140	0.53	0.3	0.4	0.6
20140430	1249	10.01	40.66	-76.37	0.4	1.9	12	21	117	0.59	0.3	0.4	0.9
20140501	1538	26.27	40.58	-79.11	0.9	2.2	7	25	183	0.10	0.4	0.6	0.8
20140502	1731	27.05	41.46	-77.35	0.0	2.3	9	29	158	0.45	0.3	1.2	0.8
20140502	1824	56.11	40.84	-78.98	20.2	1.9	5	7	158	0.59	0.6	1.2	1.4
20140502	1947	1.2	40.30	-77.94	20.9	2.2	5	28	156	0.12	0.5	1.1	1.2
20140505	1247	22	40.62	-79.01	13.5	1.8	5	18	159	0.10	0.4	0.8	0.8
20140505	1612	52.87	40.81	-78.44	0.0	2.0	5	16	139	0.13	0.4	0.6	2.5
20140506	1315	19.5	41.16	-78.75	0.1	2.0	5	34	117	0.66	0.3	0.5	99.0
20140507	1523	58.75	41.07	-78.41	1.3	2.2	5	19	175	0.27	0.4	0.9	2.6
20140507	1539	20.69	40.80	-78.52	8.7	1.9	5	23	149	0.19	0.4	1.5	2.5
20140507	1834	35.46	41.43	-77.35	2.5	2.5	9	28	170	0.47	0.3	0.7	0.6
20140508	1223	45.75	40.49	-78.89	7.5	1.8	7	16	83	0.16	0.3	0.5	1.5
20140508	1313	19.76	40.67	-76.39	3.7	1.8	6	34	100	0.31	0.4	0.4	0.7
20140508	1918	25.28	41.10	-78.33	0.0	1.9	5	20	95	0.53	0.4	0.6	3.3
20140509	1316	33.91	40.69	-78.47	0.1	2.1	6	29	124	0.27	0.4	0.6	1.3
20140512	1431	55.82	40.71	-76.29	4.7	2.3	7	39	230	0.25	0.5	1.0	0.8

20140512	1527	8.6	40.47	-78.50	4.4	2.0	6	23	120	0.38	0.3	0.5	0.9
20140512	1612	14.05	40.87	-78.24	0.0	1.9	5	8	114	0.61	0.4	0.6	3.0
20140513	1617	22.98	41.07	-78.34	0.0	2.0	5	17	92	0.40	0.4	0.6	3.2
20140513	1727	14.1	40.94	-78.96	0.0	2.0	5	18	189	0.39	0.4	1.5	1.3
20140514	1342	47.08	41.13	-78.74	0.0	1.7	4	1	213	0.27	0.4	1.0	99.0
20140514	1725	32.2	40.69	-78.71	0.0	2.0	6	26	122	0.10	0.4	0.4	2.6
20140515	1251	53.61	39.82	-79.97	28.8	2.1	5	36	109	0.31	0.5	0.6	0.9
20140515	1317	58.31	41.32	-78.71	0.0	1.9	5	17	121	0.29	0.3	0.5	99.0
20140515	1504	55.22	41.11	-75.84	0.0	2.1	5	21	113	0.95	0.4	0.5	1.2
20140515	1808	52.07	41.06	-78.35	0.0	1.9	5	16	158	0.39	0.3	0.7	2.8
20140516	1334	26.55	40.94	-78.46	0.0	1.7	5	14	89	0.37	0.4	0.4	99.0
20140519	2010	40.57	41.08	-78.29	0.1	1.5	5	18	110	0.51	0.3	0.4	99.0
20140520	1320	2.85	40.94	-78.21	0.0	1.9	5	8	138	0.58	0.4	0.5	99.0
20140520	1411	55.15	41.34	-75.79	2.8	1.6	5	37	183	0.61	0.3	1.3	0.8
20140520	1514	57.03	40.72	-76.29	2.6	2.1	6	39	226	0.43	0.4	1.1	1.1
20140520	1836	28.95	40.87	-78.23	0.0	2.1	7	8	98	0.66	0.3	0.4	2.4
20140521	1635	2.78	40.06	-79.45	0.2	1.6	6	20	150	0.57	0.3	0.8	2.7
20140521	1716	38.82	40.90	-78.23	0.0	1.8	6	6	151	0.54	0.3	0.5	99.0
20140522	1312	1.25	40.68	-76.37	0.1	1.5	5	23	120	0.20	0.4	0.4	99.0
20140522	1826	1.28	41.12	-78.34	0.0	2.1	7	22	83	0.66	0.3	0.4	2.6
20140522	1913	55.7	40.40	-79.50	7.8	2.0	5	27	255	0.23	0.5	2.0	1.2
20140523	1344	12.22	40.68	-78.09	0.1	1.8	5	33	116	0.30	0.3	0.5	99.0
20140523	1539	9.68	40.84	-78.42	0.0	1.7	4	13	141	0.11	0.3	0.7	99.0
20140527	1742	38.08	40.71	-76.30	0.0	1.9	9	38	104	0.38	0.3	0.4	2.4
20140527	1758	58.64	40.88	-78.24	0.0	1.6	4	6	154	0.60	0.4	1.0	3.2
20140528	1232	34.55	40.72	-76.10	16.5	1.2	4	36	138	0.11	0.5	1.2	14.0
20140528	1507	42.37	41.33	-78.68	0.0	1.8	4	17	134	0.19	0.4	0.6	99.0
20140528	1512	10.29	41.09	-78.34	0.1	1.9	6	19	140	0.49	0.4	0.5	2.6
20140528	1538	8.67	40.56	-77.68	32.6	1.9	5	19	134	0.07	0.5	0.9	1.3
20140528	1819	30.37	40.76	-78.52	0.0	2.0	4	26	137	0.99	0.4	0.6	99.0
20140529	1345	16.66	41.56	-77.74	32.0	1.6	4	109	244	0.88	0.6	2.2	33.3
20140529	1355	20.19	40.82	-76.33	0.0	2.1	7	33	106	0.51	0.3	0.4	1.0
20140529	1909	14.08	40.10	-79.23	0.0	2.1	6	13	90	0.41	0.4	0.4	1.1
20140530	1618	58.73	41.08	-78.25	0.0	1.6	4	19	185	1.05	0.4	1.0	99.0
20140604	1727	4.27	40.82	-76.10	0.0	2.1	6	30	119	0.27	0.3	0.4	99.0
20140604	2021	15.17	41.04	-79.68	8.2	1.9	6	27	134	0.46	0.4	0.7	1.2
20140606	1838	49.44	41.07	-78.32	0.0	1.7	5	17	146	0.50	0.3	0.7	2.8
20140606	1901	28.8	39.97	-79.38	0.0	2.3	6	28	93	0.37	0.3	0.6	3.1
20140609	1745	46.06	40.91	-78.21	0.0	1.8	5	8	148	0.59	0.4	0.5	99.0
20140609	1841	15.28	40.99	-78.32	0.1	1.7	4	8	124	0.15	0.4	0.5	99.0
20140610	1650	31.35	41.12	-78.31	0.0	1.8	4	22	140	0.23	0.3	0.6	99.0
20140610	1752	17.85	41.47	-77.33	0.0	2.4	6	28	175	0.49	0.4	1.6	1.1
20140611	1332	22.82	40.94	-78.21	0.0	1.7	5	8	143	0.71	0.4	0.5	99.0
20140616	1332	10.37	40.48	-78.50	4.1	1.9	24	11	69	0.43	0.2	0.2	0.9
20140616	1347	9.36	40.70	-76.36	0.0	1.6	5	25	107	0.25	0.3	0.4	99.0
20140616	1652	4.88	40.07	-79.31	0.0	2.0	9	15	117	0.18	0.3	0.4	99.0
20140616	1824	20.47	41.11	-78.29	0.0	1.5	52	21	57	0.77	0.1	0.1	1.1
20140616	1853	37.06	40.85	-78.22	0.0	2.0	13	10	74	0.65	0.2	0.3	2.2
20140617	1543	31.64	41.48	-77.35	0.1	2.4	23	27	49	0.46	0.2	0.2	0.5
20140617	2024	30.45	40.92	-78.27	0.0	1.9	9	3	88	0.73	0.3	0.3	99.0

20140618	1425	35.96	41.34	-78.73	0.0	1.9	7	15	82	0.57	0.3	0.4	99.0
20140618	1518	0.57	39.88	-77.49	0.5	1.5	7	23	98	0.19	0.3	0.4	99.0
20140618	1541	47.54	40.66	-78.48	4.8	2.0	9	14	97	0.20	0.3	0.4	1.2
20140618	1612	2.26	40.87	-78.24	0.0	1.9	11	8	71	0.62	0.3	0.3	2.2
20140618	1749	33.41	41.09	-78.38	4.4	2.1	14	20	58	0.68	0.3	0.3	0.8
20140620	1421	12.72	40.72	-76.23	10.8	1.2	5	33	115	0.43	0.4	0.5	9.5
20140620	1431	9.02	40.79	-76.31	0.0	2.1	8	35	97	0.61	0.3	0.4	99.0
20140620	1436	43.87	40.85	-78.25	0.0	1.9	11	9	61	0.74	0.2	0.3	99.0
20140620	1527	59.89	41.12	-78.37	0.0	2.2	12	23	62	0.67	0.3	0.3	2.2
20140620	1649	53.87	40.00	-76.08	5.8	1.6	7	21	96	0.18	0.3	0.4	3.9
20140623	1531	12.94	40.69	-76.18	32.0	1.3	5	35	128	0.22	0.5	0.8	6.0
20140623	1552	58.52	41.10	-78.23	0.0	1.6	6	21	118	1.09	0.3	0.4	99.0
20140623	1756	40.2	41.88	-75.33	0.0	1.8	7	38	137	0.24	0.3	0.5	99.0
20140624	1422	19.36	40.63	-76.50	0.3	1.6	5	30	101	0.11	0.4	0.4	99.0
20140624	1513	6.28	40.56	-78.28	0.0	1.6	5	11	120	1.03	0.4	0.5	99.0
20140624	1538	36.85	41.09	-78.34	2.8	2.1	10	19	68	0.34	0.3	0.3	1.4
20140625	1324	16.84	40.66	-76.39	0.0	1.6	6	34	98	0.65	0.3	0.4	99.0
20140625	1439	24.13	40.65	-78.41	0.0	1.7	6	12	139	0.53	0.3	0.6	99.0
20140626	1514	23.06	40.81	-76.38	0.1	1.9	11	29	87	0.42	0.2	0.3	99.0
20140627	1540	42.84	41.61	-75.87	9.5	1.8	6	10	119	0.20	0.4	0.9	1.2
20140627	1639	57.03	40.06	-79.27	0.0	1.9	7	17	101	0.80	0.3	0.4	99.0
20140701	1613	40.86	40.78	-76.31	0.0	2.0	6	35	211	0.45	0.3	1.0	0.8
20140701	1616	58.99	40.74	-76.28	15.4	2.0	5	39	138	0.19	0.4	0.6	1.5
20140701	1748	22.13	41.46	-77.39	2.0	2.6	17	32	81	0.67	0.2	0.2	0.9
20140701	1900	3.55	40.30	-74.89	0.0	1.8	13	9	202	0.54	0.3	0.7	0.6
20140701	1952	1.86	39.75	-79.72	0.3	1.9	11	22	85	0.60	0.3	0.4	0.7
20140702	1333	3.72	40.76	-78.52	0.1	1.9	4	26	137	1.39	0.4	0.6	99.0
20140702	1415	55.46	41.14	-78.12	18.5	1.9	4	28	137	0.00	0.5	0.8	1.7
20140702	1902	40.71	41.47	-77.41	0.1	2.4	14	64	67	0.52	0.3	0.3	0.6
20140702	2132	57.5	40.91	-78.31	0.0	1.9	6	1	84	0.99	0.3	0.4	33.3
20140703	1345	56.18	40.88	-78.27	0.0	2.0	4	5	154	0.60	0.4	0.8	2.9
20140703	1634	49.28	41.08	-78.43	0.0	2.1	5	21	92	0.62	0.4	0.5	2.8
20140708	1329	20.08	40.84	-76.26	9.9	1.6	5	39	164	0.50	0.3	1.0	33.3
20140708	1745	43.99	40.43	-77.87	1.4	2.0	18	31	92	0.68	0.2	0.3	0.5
20140709	1345	27.18	41.02	-76.72	0.0	1.7	9	19	82	0.43	0.3	0.4	0.8
20140709	1426	30.11	41.15	-78.08	0.0	1.9	8	32	79	0.67	0.3	0.4	2.3
20140709	1911	47.07	41.46	-77.37	0.1	2.4	38	24	40	0.76	0.2	0.2	0.4
20140710	1408	16.36	40.62	-79.11	0.0	1.9	9	20	190	0.53	0.4	0.7	0.8
20140710	1823	24.32	41.16	-78.37	0.0	1.8	6	27	86	0.79	0.3	0.6	3.0
20140711	1409	49.33	41.47	-77.39	0.0	2.4	30	23	40	0.68	0.2	0.2	0.4
20140714	1329	40.8	40.25	-75.70	0.0	1.5	4	26	198	0.76	0.4	1.1	2.4
20140715	1325	8.99	41.14	-78.13	0.0	1.8	5	29	137	0.69	0.4	0.5	99.0
20140715	1346	15.27	40.68	-78.69	0.0	1.7	4	28	128	0.27	0.4	0.5	99.0
20140715	1358	16.84	40.72	-76.29	0.1	1.6	4	31	134	0.21	0.4	0.5	99.0
20140715	1515	5.67	40.48	-77.13	0.0	1.7	5	6	165	0.48	0.3	0.6	99.0
20140716	1526	11.79	41.07	-78.32	0.0	2.1	10	17	67	0.54	0.3	0.3	1.0
20140716	1550	44.88	40.52	-79.03	3.0	2.2	6	42	158	0.92	0.4	2.1	3.0
20140717	1315	4.22	40.99	-76.74	0.2	1.8	5	17	158	0.24	0.4	0.5	99.0
20140717	1728	56.92	41.40	-77.38	0.0	2.3	25	21	172	1.38	0.2	0.3	0.4
20140717	1754	18.03	40.68	-76.06	0.0	2.0	8	36	137	1.05	0.3	0.4	1.7

20140718	1334	25.26	40.05	-79.53	0.0	1.5	8	26	170	0.56	0.3	0.6	1.1
20140718	1612	38.22	41.11	-78.28	0.0	1.6	7	21	114	0.56	0.3	0.4	99.0
20140724	1342	17.55	40.70	-76.31	1.0	2.0	11	38	104	0.61	0.3	0.4	0.7
20140725	1344	46.02	41.14	-78.05	0.0	1.9	6	32	89	0.98	0.4	0.4	2.5
20140725	1515	18.16	40.50	-78.46	2.7	2.1	11	7	110	0.70	0.3	0.4	0.6
20140725	1723	4.56	41.11	-78.37	0.1	2.0	6	22	100	0.48	0.3	0.4	99.0
20140728	1603	59.69	40.15	-79.21	0.3	1.8	8	10	209	0.34	0.3	1.0	0.8
20140728	1814	22.71	40.45	-78.93	7.3	2.1	5	36	121	0.64	0.4	0.5	0.9
20140728	1953	53.28	41.01	-79.70	0.0	2.0	4	25	160	0.44	0.4	0.6	99.0
20140729	1427	8.23	40.05	-80.04	0.0	1.8	5	32	137	0.51	0.4	0.5	2.7
20140729	1841	59.77	40.83	-78.22	0.0	2.0	7	12	105	1.10	0.3	0.4	2.6
20140729	2012	7.27	40.44	-78.10	27.8	2.0	7	44	189	0.94	0.5	0.9	0.6
20140730	1239	52.44	41.12	-78.09	0.5	2.0	7	28	85	0.30	0.3	0.4	1.6
20140730	1531	44.16	40.82	-78.51	0.0	2.1	9	21	117	0.50	0.3	0.4	1.0
20140730	1642	15.99	41.11	-78.15	0.1	2.1	7	25	76	0.99	0.3	0.4	99.0
20140730	1905	53.65	41.43	-77.35	0.0	2.5	13	29	155	0.63	0.2	0.5	0.6
20140731	1343	13.74	40.71	-76.31	0.0	1.8	5	37	186	0.87	0.3	1.1	2.6
20140731	1426	54.76	40.68	-78.68	8.1	1.8	6	28	208	0.65	0.5	0.9	0.9
20140804	1209	4.73	40.71	-76.33	0.1	1.3	5	27	109	0.17	0.3	0.5	99.0
20140804	1345	17.67	40.97	-75.74	2.0	1.8	5	6	181	0.66	0.4	0.8	1.0
20140804	1437	56.33	39.95	-79.32	0.0	1.9	5	29	114	0.70	0.3	0.5	99.0
20140804	1711	12.96	40.93	-78.45	0.0	1.5	6	13	87	0.66	0.3	0.4	99.0
20140804	1825	5.28	40.16	-79.21	0.0	1.9	4	10	130	0.59	0.4	0.5	99.0
20140805	1300	13.53	41.02	-76.70	0.0	1.8	5	20	124	0.43	0.3	0.5	99.0
20140806	1804	1.59	41.00	-79.62	4.9	2.4	7	32	197	0.48	0.4	0.8	0.8
20140806	1844	29.29	40.54	-78.47	0.0	2.1	7	31	117	0.59	0.3	0.4	1.0
20140807	1839	47.36	40.83	-79.70	19.5	2.2	7	28	146	0.83	0.4	0.7	0.7
20140808	1712	13.5	40.55	-79.80	13.8	2.3	5	49	258	0.95	0.7	1.9	1.0
20140808	1930	51.15	41.08	-78.41	0.0	2.1	6	20	91	0.62	0.3	0.4	99.0
20140811	1723	36.09	40.84	-79.65	11.3	2.3	8	31	65	1.02	0.3	0.4	1.1
20140811	1853	14.95	40.84	-78.43	0.0	1.7	5	14	193	1.12	0.4	1.0	1.4
20140811	2015	19.65	40.47	-77.86	0.1	1.8	10	34	92	0.50	0.3	0.4	0.6
20140812	1749	9.97	41.33	-78.73	0.0	1.6	4	16	153	0.50	0.3	0.7	99.0
20140812	1904	18.89	40.82	-79.69	7.0	2.1	7	29	82	1.49	0.4	0.4	0.8
20140813	1808	41.77	40.44	-78.53	0.1	2.0	4	19	124	0.07	0.4	0.5	99.0
20140814	1651	54.74	40.96	-79.59	2.7	2.3	7	34	203	1.12	0.3	0.8	0.9
20140814	1656	16.32	41.07	-78.36	0.0	2.0	5	18	160	0.41	0.3	0.6	99.0
20140815	1316	34.2	39.99	-79.38	0.1	1.7	4	26	160	0.31	0.4	0.6	99.0
20140815	1504	4.22	40.51	-79.00	0.6	2.2	7	9	126	1.57	0.4	0.5	16.4
20140815	2312	49.08	40.96	-79.76	17.3	2.0	9	19	188	0.70	0.4	0.7	0.5
20140816	1338	12.64	40.21	-78.75	0.0	2.1	5	17	203	0.43	0.4	0.9	2.3
20140818	1512	1.94	40.83	-79.52	0.0	2.1	4	45	148	0.71	0.4	0.6	99.0
20140819	1848	8.16	41.40	-77.38	0.0	2.6	12	30	182	0.77	0.3	0.6	0.6
20140821	1606	27.46	41.34	-78.71	6.7	2.1	5	15	145	0.03	0.4	0.6	0.9
20140821	1622	39.32	40.85	-79.81	0.0	2.3	4	19	258	0.95	0.5	1.7	99.0
20140822	1147	35.38	41.15	-78.06	0.0	1.9	12	32	89	1.03	0.2	0.3	0.7
20140822	1341	55.5	41.11	-78.06	0.0	1.5	6	29	90	0.51	0.4	0.4	2.5
20140822	1415	3.18	40.71	-76.33	1.4	2.1	6	46	101	0.54	0.3	0.6	1.2
20140822	1729	2.85	39.84	-80.03	0.6	2.2	9	34	95	0.83	0.3	0.4	1.0
20140825	1947	53.07	41.06	-78.38	0.0	2.1	5	17	171	0.20	0.4	0.6	2.5

20140826	1346	1.13	40.76	-76.25	5.0	2.2	12	41	108	0.71	0.2	0.3	0.7
20140826	1747	56.29	40.29	-78.87	0.0	2.0	5	26	206	1.26	0.4	0.8	99.0
20140827	1259	53.74	41.14	-78.08	13.0	1.5	5	39	167	0.41	0.4	0.7	1.9
20140828	1330	58.95	40.82	-78.66	2.8	2.1	11	28	86	0.26	0.3	0.3	0.9
20140828	1408	57.67	40.70	-78.40	0.0	2.3	7	26	109	0.79	0.3	0.5	2.5
20140828	1542	54.44	41.14	-78.43	12.0	2.2	7	27	98	0.48	0.3	0.5	1.1
20140828	1613	58.51	41.06	-75.87	0.0	1.6	6	3	100	1.25	0.3	0.4	99.0
20140828	1628	1.85	40.69	-78.71	0.1	1.7	6	26	121	0.90	0.3	0.5	99.0
20140902	1459	21.98	41.00	-76.71	0.0	2.1	6	18	87	0.73	0.4	0.4	2.6
20140902	1536	14.57	39.84	-79.88	0.0	2.6	8	37	90	0.39	0.4	0.4	0.9
20140903	1315	51.85	40.15	-76.02	0.0	1.5	5	55	198	1.20	0.4	1.0	2.6
20140903	1423	0.1	40.51	-78.22	0.0	1.8	6	39	104	1.74	0.4	0.4	1.0
20140903	1447	27.3	40.68	-79.82	0.0	2.0	5	34	115	0.56	0.4	0.5	1.1
20140904	1529	31.07	40.74	-76.32	0.1	2.1	4	36	221	0.39	0.5	1.2	2.7
20140904	1617	49.18	41.07	-78.32	6.8	2.1	7	17	80	0.56	0.4	0.4	0.9
20140904	1912	53.91	41.18	-79.87	18.6	1.9	6	26	183	0.89	0.5	1.6	1.3
20140905	1236	15.89	40.71	-78.55	0.0	2.0	4	22	120	0.35	0.4	0.5	99.0
20140905	1841	36.94	40.61	-79.40	0.1	2.1	7	39	190	0.20	0.4	0.9	0.9
20140905	2000	10.85	40.26	-76.52	0.0	1.3	5	27	168	0.23	0.3	0.7	99.0
20140908	1501	13.57	40.56	-76.88	19.1	1.9	5	29	138	0.09	0.4	0.7	1.4
20140908	1616	58.98	40.90	-75.88	10.0	1.7	7	9	156	0.66	0.3	0.6	1.1
20140908	1855	45.74	41.26	-78.55	0.1	1.7	4	29	163	0.18	0.4	0.6	99.0
20140909	1233	43.69	41.06	-78.36	0.0	2.0	7	16	84	0.60	0.3	0.4	2.3
20140909	1514	0.48	40.86	-76.25	0.6	2.1	9	40	95	1.39	0.3	0.4	0.9
20140909	1637	28.46	41.11	-78.27	0.0	1.7	5	22	109	1.01	0.4	0.7	3.8
20140910	1632	18.76	40.09	-76.57	0.1	1.7	4	30	115	0.15	0.4	0.5	99.0
20140910	1802	22.72	41.09	-78.34	0.0	2.2	6	19	82	0.45	0.3	0.4	2.6
20140911	1617	44.18	39.83	-79.75	0.0	1.9	4	15	141	1.08	0.4	0.5	99.0
20140911	1649	27.59	41.16	-78.73	0.2	1.6	4	35	156	0.12	0.4	0.6	99.0
20140911	1816	57.31	40.82	-78.51	15.1	1.9	5	21	154	0.23	0.4	0.6	2.0
20140912	1404	28.42	40.46	-78.89	0.0	1.7	5	18	103	0.14	0.4	0.4	99.0
20140912	1606	27.74	41.11	-78.35	0.0	2.0	5	43	157	1.87	0.4	0.7	2.7
20140912	1615	56.59	39.84	-79.04	0.1	1.6	4	41	176	0.31	0.4	0.6	99.0
20140912	1934	40.88	41.10	-78.40	0.0	2.3	6	22	90	0.70	0.3	0.4	2.5
20140915	1722	6.42	41.36	-78.75	9.4	2.0	5	12	91	0.22	0.4	1.7	2.1
20140915	1751	6.94	40.91	-78.51	0.1	1.6	5	17	133	1.05	0.4	0.5	99.0
20140915	1818	53.88	40.89	-75.91	0.0	1.6	5	12	172	0.91	0.4	0.7	2.8
20140916	1516	15.44	40.85	-77.74	19.7	1.4	5	21	208	0.18	0.4	1.7	1.2
20140916	1636	6.66	40.78	-76.38	0.0	1.6	9	30	168	0.81	0.3	0.6	1.0
20140916	1700	34.65	40.38	-78.45	5.1	1.7	5	16	171	0.40	0.4	0.8	1.0
20140916	1717	14.23	40.68	-78.70	0.0	1.8	5	27	116	0.19	0.3	0.5	99.0
20140917	1233	46.68	41.61	-77.08	0.1	1.6	4	27	158	0.16	0.4	0.7	99.0
20140917	1516	45.55	40.77	-76.31	0.1	2.1	10	35	99	0.52	0.3	0.4	0.8
20140918	1407	24.25	39.99	-79.36	4.3	2.2	10	26	77	0.42	0.3	0.4	0.7
20140918	1609	33.72	41.09	-78.28	0.2	1.6	4	19	132	0.03	0.4	0.6	99.0
20140918	1623	18.52	41.30	-78.67	0.0	1.7	5	20	117	0.63	0.4	0.9	5.0
20140918	1828	25.25	41.44	-76.42	0.0	1.6	4	8	180	0.26	0.4	0.9	99.0
20140918	1858	0.26	40.83	-76.12	0.0	1.4	5	31	152	0.59	0.4	0.6	2.7
20140919	1510	31.88	40.83	-78.54	0.0	2.1	5	23	165	0.35	0.4	0.7	1.0
20140919	2115	25.46	40.56	-79.24	0.0	2.0	4	32	212	0.73	0.4	1.0	99.0

20140922	1320	13.5	40.76	-76.12	0.3	1.5	4	35	129	0.15	0.4	0.6	99.0
20140922	1847	26.48	40.81	-78.46	0.1	2.0	7	18	94	0.80	0.4	0.4	2.3
20140923	1941	4.2	40.46	-77.95	0.1	1.8	7	40	87	0.50	0.3	0.4	99.0
20140924	1644	11.56	40.39	-78.46	8.5	1.6	5	16	197	0.14	0.4	1.1	1.2
20140924	1734	46.63	41.48	-77.36	0.0	2.3	10	31	159	0.62	0.3	0.5	0.9
20140925	1414	39.57	40.84	-78.45	0.0	1.6	4	15	153	0.68	0.4	0.6	99.0
20140926	1513	53.51	40.85	-78.47	0.1	1.7	6	16	190	0.32	0.4	0.8	1.3
20140926	1625	40.38	41.07	-78.41	0.0	2.1	7	19	144	0.51	0.3	0.5	2.3
20140929	1300	14.13	40.92	-78.30	0.0	2.0	7	0	130	0.59	0.3	0.4	33.3
20140929	1441	39.42	41.71	-76.44	0.0	1.9	5	38	100	0.68	0.4	0.4	99.0
20140929	1852	57.94	41.41	-77.37	0.9	2.3	9	30	162	0.45	0.2	1.3	0.6
20140930	1414	13.54	41.01	-76.55	0.1	1.7	5	23	160	1.34	0.4	0.6	2.6
20140930	1600	36.59	40.95	-75.96	0.0	1.8	7	16	156	0.39	0.3	0.6	1.1
20140930	1742	15.37	40.67	-78.69	0.0	1.8	5	27	112	0.32	0.3	0.5	99.0
20141001	1214	28.4	40.45	-78.67	0.1	2.2	6	22	113	0.58	0.4	0.6	1.0
20141001	1229	9.07	40.09	-77.47	3.8	1.3	7	16	99	0.34	0.3	0.4	0.9
20141001	1322	57.42	40.96	-78.33	0.0	1.7	9	59	106	0.54	0.3	0.4	1.1
20141001	1522	54.79	40.81	-78.40	27.9	1.5	5	15	128	0.34	0.6	0.7	0.8
20141002	1401	42.81	40.65	-76.42	25.9	1.4	7	33	95	0.44	0.3	0.5	0.8
20141002	1554	40.39	40.91	-78.92	0.0	2.1	6	16	114	0.44	0.4	0.6	3.2
20141002	1720	0.91	40.97	-75.93	5.6	2.4	10	14	85	0.61	0.3	0.3	0.8
20141003	1232	33.3	40.69	-76.12	0.0	1.4	9	39	98	1.23	0.2	0.4	99.0
20141003	1357	8.49	41.69	-75.63	0.0	1.7	6	15	159	0.48	0.4	0.6	99.0
20141003	1642	35.76	40.41	-78.53	0.1	1.7	7	16	156	0.20	0.3	0.4	99.0
20141003	1654	40.42	40.98	-76.92	0.1	1.8	6	23	106	0.55	0.3	0.5	2.5
20141003	1702	45.51	41.10	-78.28	0.0	2.2	5	20	177	0.62	0.4	0.7	99.0
20141003	1950	1.05	41.45	-77.40	19.9	2.7	14	33	60	0.89	0.2	0.3	0.5
20141004	2346	14.75	40.01	-80.42	0.0	1.8	6	13	106	0.77	0.3	0.4	99.0
20141006	1345	15.63	40.47	-78.95	4.1	2.2	9	14	105	0.70	0.3	0.4	1.4
20141006	1538	55.46	40.82	-76.39	0.0	1.6	6	28	141	0.61	0.3	0.5	99.0
20141006	1604	17.97	40.96	-78.23	0.0	1.7	10	7	110	0.63	0.3	0.3	99.0
20141006	1635	29.03	41.13	-78.27	0.0	2.1	12	23	75	0.76	0.3	0.3	2.2
20141007	1538	1.38	39.97	-79.39	0.0	2.0	8	23	133	0.82	0.2	0.5	99.0
20141007	1603	20.28	41.28	-75.72	0.0	1.8	6	25	101	0.30	0.3	0.4	99.0
20141007	1846	32.89	41.47	-77.38	0.9	2.1	12	32	61	0.38	0.2	0.3	2.1
20141008	1604	0.78	40.88	-75.93	8.1	1.8	5	14	167	0.23	0.5	1.5	2.5
20141009	1419	39.31	41.13	-79.39	9.5	1.9	8	27	97	0.77	0.3	0.4	1.1
20141009	1649	30.88	41.10	-78.30	0.0	2.1	11	20	81	0.72	0.3	0.3	2.3
20141009	1908	5.56	41.46	-77.38	0.0	2.2	14	31	82	0.52	0.2	0.3	1.3
20141010	1307	38	41.14	-78.28	0.0	2.0	11	24	76	0.49	0.3	0.3	99.0
20141010	1642	12.49	40.83	-76.72	4.5	1.8	9	1	75	0.59	0.3	0.4	0.7
20141013	1501	5.38	41.44	-75.54	0.0	1.9	12	15	51	0.46	0.2	0.3	99.0
20141013	1606	20.93	41.01	-75.96	0.0	1.7	10	11	83	0.29	0.3	0.3	99.0
20141013	1651	0.26	40.83	-80.04	0.0	2.1	7	15	110	0.40	0.4	0.9	99.0
20141013	1855	15.68	41.48	-77.35	2.0	2.2	12	31	79	0.39	0.3	0.3	1.3
20141014	1947	48.61	41.43	-77.33	0.0	2.1	11	26	63	0.43	0.3	0.3	2.2
20141015	1300	43.33	40.72	-76.08	3.2	1.7	10	35	142	0.40	0.3	0.4	1.2
20141015	1346	57.45	40.81	-76.26	3.2	2.0	8	39	101	0.26	0.3	0.5	1.5
20141016	1346	28.89	40.94	-78.41	16.7	1.9	8	9	127	0.44	0.3	0.5	0.8
20141016	1504	3.29	41.43	-75.55	0.0	1.9	6	16	86	0.74	0.3	0.4	99.0

20141017	1745	10.74	41.40	-77.39	0.0	2.0	11	32	88	0.62	0.2	0.3	99.0
20141017	1808	35.3	40.88	-78.45	1.9	1.6	7	13	122	0.60	0.3	0.5	1.9
20141017	2154	44.83	40.74	-76.21	0.1	1.5	6	36	115	0.12	0.3	0.5	99.0
20141020	1305	18.98	40.93	-78.05	0.0	1.9	6	21	209	0.46	0.4	0.9	99.0
20141020	1530	50.85	41.07	-78.32	0.0	1.9	11	17	83	0.47	0.3	0.3	99.0
20141020	1644	7.96	40.75	-75.99	0.0	1.6	11	26	65	0.50	0.3	0.3	2.2
20141021	1359	49.19	40.28	-75.72	0.0	1.1	7	23	151	0.13	0.3	0.4	99.0
20141021	1450	7.49	40.84	-78.43	7.2	1.9	8	14	114	0.59	0.3	0.4	1.0
20141021	1512	25.16	40.83	-78.41	6.4	1.7	7	14	118	0.29	0.3	0.5	1.2
20141021	1639	35.16	40.71	-76.28	0.0	1.1	7	30	133	0.53	0.3	0.5	99.0
20141022	1408	18.58	40.93	-79.82	4.9	2.1	7	15	90	0.24	0.4	0.5	3.7
20141022	1508	26.58	40.96	-76.92	0.0	1.5	7	21	88	0.23	0.3	0.3	99.0
20141022	1752	14.13	40.60	-79.02	4.1	2.2	9	2	88	0.10	0.3	0.4	0.8
20141023	1439	19.26	40.79	-76.20	0.0	2.0	9	39	111	0.62	0.3	0.3	99.0
20141023	1526	42.56	40.54	-78.50	0.7	2.2	11	7	79	0.21	0.2	0.3	2.1
20141023	1627	14.07	40.78	-78.24	2.2	1.9	6	30	149	0.28	0.4	0.7	3.2
20141023	1700	21.55	40.84	-75.78	0.0	1.8	9	9	65	0.36	0.3	0.3	99.0
20141024	1433	33.49	40.03	-77.18	4.8	1.7	9	11	142	0.19	0.3	0.5	1.4
20141024	1506	17.95	40.73	-76.22	21.8	1.5	5	35	117	0.10	0.4	0.6	5.8
20141024	1512	55.73	40.86	-78.49	0.0	1.8	8	18	168	0.48	0.3	0.5	99.0
20141024	1831	4.03	40.90	-79.11	0.1	1.8	7	16	180	0.77	0.3	0.6	99.0
20141024	1844	39.07	40.79	-80.08	0.1	2.0	7	20	87	0.45	0.3	0.4	99.0
20141027	1419	55.95	40.86	-76.00	0.0	1.5	7	20	106	0.63	0.3	0.4	99.0
20141027	1509	12.78	40.80	-78.56	0.0	1.9	8	26	116	0.64	0.3	0.4	99.0
20141027	1600	1.77	40.95	-78.99	0.0	1.9	9	19	73	0.69	0.3	0.3	99.0
20141028	1332	35.5	40.93	-76.97	0.1	1.6	10	20	67	0.53	0.3	0.3	99.0
20141028	1538	47.34	40.17	-80.11	0.0	2.0	6	23	79	0.44	0.3	0.4	99.0
20141028	1813	13.31	40.43	-78.56	11.0	1.9	7	17	129	0.49	0.3	0.6	1.0
20141029	1250	13.89	40.81	-78.30	0.0	1.6	5	31	190	0.21	0.4	0.7	99.0
20141029	1321	3.21	41.08	-77.03	20.1	1.4	5	18	135	0.16	0.5	0.6	1.2
20141029	1429	17.81	41.10	-75.86	0.0	1.5	6	2	95	0.76	0.3	0.4	33.3
20141029	1525	26.07	41.34	-78.69	0.1	2.0	6	44	129	0.28	0.4	0.4	99.0
20141029	1538	12.16	40.95	-78.23	0.0	1.9	9	7	110	0.76	0.2	0.4	99.0
20141029	1611	58.79	41.06	-78.31	0.0	1.9	10	16	106	0.82	0.2	0.4	99.0
20141030	1317	25.8	40.69	-76.35	0.0	1.4	6	24	104	0.50	0.3	0.5	99.0
20141031	1516	51.94	40.80	-76.25	0.1	2.1	12	39	55	0.47	0.2	0.3	99.0
20141031	1625	54.96	40.75	-76.47	0.1	2.0	11	23	66	0.43	0.2	0.3	99.0
20141031	1844	42.61	41.09	-78.26	0.0	1.8	8	19	139	0.72	0.3	0.5	2.4
20141103	1404	6.46	40.90	-76.05	0.2	1.4	5	23	133	0.34	0.3	0.6	99.0
20141103	1703	14.93	41.09	-78.20	0.1	1.9	8	21	120	0.77	0.3	0.4	99.0
20141103	1740	53.27	40.59	-77.31	0.0	1.7	8	19	93	1.07	0.3	0.4	99.0
20141104	1521	45.63	40.48	-78.57	0.0	1.9	10	16	71	0.93	0.3	0.3	99.0
20141105	1409	59.47	40.82	-75.92	0.0	1.2	8	16	117	0.53	0.3	0.4	99.0
20141106	1501	40.7	40.21	-77.04	0.0	1.1	7	14	121	0.33	0.3	0.4	99.0
20141106	1529	53.23	40.72	-76.31	0.2	1.4	6	37	111	0.10	0.3	0.5	99.0
20141106	1641	45.36	39.93	-79.30	0.1	2.1	6	31	207	0.17	0.3	0.9	99.0
20141106	1819	26.55	40.48	-78.80	0.1	1.9	7	23	137	0.20	0.4	0.4	99.0
20141106	2001	18.31	40.99	-75.95	0.1	1.7	7	13	78	0.42	0.3	0.3	99.0
20141107	1457	24.17	40.75	-76.47	0.1	2.0	11	24	65	0.46	0.2	0.3	99.0
20141107	1839	18.7	41.10	-78.33	0.0	2.0	7	20	150	0.45	0.3	0.5	99.0

20141110	1435	31.12	40.93	-78.29	0.0	1.9	9	1	129	0.38	0.3	0.4	99.0
20141110	1815	44.06	40.79	-78.50	0.0	2.1	4	22	225	0.25	0.4	1.3	99.0
20141111	1533	7.65	41.09	-78.50	0.0	2.2	4	25	292	0.12	0.7	4.0	33.3
20141111	1617	46.14	40.77	-76.23	0.0	1.9	8	42	181	0.72	0.3	0.6	0.9
20141113	1345	7.12	41.03	-76.71	0.0	1.6	10	21	67	0.60	0.3	0.3	2.3
20141113	1354	45	40.96	-76.92	0.0	1.6	7	22	88	0.85	0.3	0.3	99.0
20141113	1428	38.95	40.66	-76.38	0.1	1.6	8	21	97	0.33	0.3	0.4	99.0
20141113	1602	34.96	39.97	-79.43	0.0	2.0	6	20	121	0.37	0.3	0.5	99.0
20141113	1721	1.6	40.99	-75.91	0.0	1.5	8	11	76	0.80	0.3	0.3	99.0
20141114	1412	14.59	40.47	-78.53	0.1	1.8	7	13	94	0.66	0.3	0.4	99.0
20141114	1450	33.61	40.69	-78.43	0.0	2.1	7	17	127	0.41	0.3	0.5	99.0
20141114	1506	30.1	40.90	-76.02	0.0	1.9	6	24	170	0.49	0.4	0.6	2.7
20141114	1529	50.07	40.63	-78.66	0.0	1.8	8	24	123	0.52	0.3	0.4	1.0
20141114	1806	34.99	40.92	-77.39	0.0	2.3	5	59	203	0.34	0.4	1.5	2.3
20141117	1638	54.7	40.81	-76.11	2.0	1.7	12	31	122	0.57	0.2	0.4	0.8
20141117	2025	7.5	40.82	-78.44	0.0	2.0	20	17	78	0.91	0.2	0.2	1.1
20141118	1432	55.91	40.78	-76.10	0.0	1.6	5	31	146	0.35	0.4	0.5	99.0
20141120	1920	52.74	40.49	-78.43	0.0	2.2	5	6	182	0.74	0.3	0.7	33.3
20141121	1308	33.83	41.21	-77.02	0.0	1.2	5	17	139	0.57	0.3	0.5	99.0
20141121	1511	30.36	40.46	-77.86	0.1	1.7	11	33	89	0.29	0.3	0.3	2.1
20141121	1623	32.55	41.29	-75.88	20.0	1.7	9	12	103	0.27	0.3	0.4	0.6
20141121	1630	10.68	40.54	-76.20	9.1	1.6	5	26	137	0.14	0.4	0.6	1.1
20141121	1706	45.41	40.82	-76.08	0.0	1.6	6	29	123	0.79	0.3	0.5	99.0
20141121	2011	10.16	41.45	-77.37	1.8	2.2	13	30	83	0.85	0.3	0.3	0.8
20141124	1621	42.94	40.77	-78.46	0.0	1.9	5	22	209	0.45	0.4	0.9	99.0
20141124	1658	36	40.88	-75.99	0.0	1.6	6	19	117	1.59	0.3	0.4	99.0
20141125	1530	50.54	40.78	-76.31	0.1	1.9	8	35	136	0.56	0.3	0.4	0.9
20141125	1545	19.86	40.67	-76.11	0.0	1.4	6	38	195	0.28	0.3	0.8	99.0
20141125	1608	16.68	40.86	-78.50	0.0	2.1	9	18	140	0.74	0.3	0.4	99.0
20141125	1627	2.43	41.43	-77.34	0.0	2.1	12	28	62	0.48	0.2	0.3	99.0
20141126	1345	54.88	41.43	-77.37	1.2	2.0	11	30	84	0.58	0.3	0.4	0.9
20141126	1358	13.4	40.65	-76.52	0.1	1.6	6	16	182	0.23	0.4	0.6	99.0
20141126	1658	31.26	41.13	-78.31	0.0	2.0	9	23	105	0.59	0.3	0.4	99.0
20141128	1614	13.67	41.11	-78.34	0.1	2.0	8	21	104	0.78	0.3	0.4	2.5
20141202	1344	17.33	40.83	-76.65	0.0	1.6	6	6	145	0.41	0.4	0.8	2.8
20141202	1347	54.2	40.92	-78.29	0.0	1.5	6	1	100	0.26	0.4	0.4	99.0
20141202	1417	12.46	40.92	-76.24	0.2	1.8	5	41	228	0.12	0.4	1.2	99.0
20141202	1423	15.33	41.01	-75.81	3.5	1.6	7	9	96	0.06	0.3	0.4	1.9
20141202	1526	32.55	41.02	-78.39	2.8	2.1	13	13	111	0.34	0.3	0.3	0.9
20141202	1640	16.83	40.89	-76.13	0.0	1.4	8	31	135	0.25	0.3	0.5	99.0
20141203	1503	28.42	40.74	-76.45	1.9	1.5	7	25	172	0.25	0.3	0.6	2.1
20141203	1529	0.43	40.96	-76.02	0.0	1.6	8	18	154	0.67	0.3	0.5	99.0
20141203	1945	28.11	40.91	-78.30	4.5	1.9	7	2	158	0.13	0.3	0.5	0.9
20141204	1458	24.19	40.83	-78.33	0.3	1.4	6	11	129	0.26	0.3	0.7	99.0
20141204	1532	3.41	41.43	-75.57	0.0	2.0	10	17	64	0.68	0.3	0.3	99.0
20141204	1655	58.43	40.82	-78.47	12.6	1.8	7	18	85	0.54	0.3	0.4	1.6
20141204	1757	20.1	41.12	-78.34	0.0	2.1	9	22	105	0.55	0.3	0.4	2.5
20141205	1259	50.79	41.47	-75.60	0.0	1.7	7	14	102	0.70	0.3	0.4	99.0
20141205	1520	6.75	40.80	-76.31	2.9	2.1	26	35	133	0.43	0.1	0.3	0.5
20141211	1858	26.81	41.48	-77.34	2.5	2.3	14	29	76	0.75	0.3	0.3	0.8

20141212	1638	52.31	40.77	-76.28	3.0	2.2	10	38	103	0.48	0.3	0.4	0.8
20141215	1502	2.5	41.40	-75.56	2.4	1.9	11	19	91	0.74	0.2	0.3	1.7
20141215	1512	37.54	41.79	-76.82	0.0	1.9	6	24	76	0.55	0.3	0.4	99.0
20141215	1552	34.35	40.92	-78.58	0.0	1.9	8	23	102	0.56	0.3	0.4	99.0
20141216	1619	4.3	41.12	-78.33	0.0	2.0	10	22	105	0.77	0.3	0.3	2.3
20141216	1914	40.16	40.81	-78.55	0.0	2.1	5	25	180	0.51	0.4	0.7	99.0
20141216	1922	20.7	41.06	-78.47	7.7	2.1	10	21	99	0.62	0.3	0.4	0.6
20141217	1838	59.59	40.85	-75.73	4.7	1.7	7	9	126	0.12	0.4	0.4	1.8
20141217	1919	20.71	40.78	-78.48	0.0	1.9	5	22	143	0.35	0.3	0.5	99.0
20141218	1843	17.65	41.00	-77.62	0.1	1.7	7	31	149	0.46	0.4	0.4	99.0
20141218	2033	8.45	40.91	-78.28	2.5	2.0	6	2	122	0.32	0.4	0.4	0.9
20141218	2100	20.92	39.90	-78.53	0.3	1.9	7	18	146	0.13	0.4	0.6	99.0
20141219	1344	58.12	40.92	-78.58	0.0	1.8	8	24	150	0.32	0.4	0.5	2.2
20141219	1431	3.65	41.45	-75.73	10.4	2.0	8	13	114	0.33	0.3	0.4	1.4
20141219	1453	50.89	41.21	-78.29	0.1	1.9	8	32	182	0.25	0.3	0.6	99.0
20141219	1516	18.17	40.05	-76.52	0.1	1.3	6	26	112	0.11	0.3	0.4	99.0
20141219	1648	33.15	41.44	-77.36	0.0	2.3	5	29	143	0.67	0.4	0.5	99.0
20141219	1653	31.37	40.84	-76.55	0.0	2.0	10	38	193	0.47	0.3	0.7	2.2
20141219	1741	6.38	40.72	-78.37	0.1	1.7	8	20	126	0.12	0.3	0.4	99.0
20141219	1808	16.97	40.91	-78.30	0.1	2.0	8	1	105	0.12	0.3	0.5	19.5
20141222	1537	41.72	40.96	-78.29	0.8	1.8	9	4	130	0.38	0.3	0.4	3.9
20141222	1545	10.19	40.85	-75.95	2.1	1.6	11	17	71	0.09	0.3	0.3	6.7
20141223	1628	28.58	40.42	-78.69	0.1	2.2	8	20	169	0.32	0.3	0.5	99.0
20141223	1700	23.23	40.36	-76.34	0.1	1.1	6	14	153	0.10	0.3	0.5	99.0
20141223	1753	8.93	40.71	-78.53	0.0	2.0	8	21	152	0.11	0.3	0.5	99.0
20141223	1911	29.49	40.07	-78.76	0.0	1.6	8	12	196	0.20	0.3	0.7	2.2
20141224	1411	59.1	41.16	-78.09	0.0	1.8	6	32	133	0.79	0.4	0.5	2.5
20141224	1515	51.85	40.54	-78.53	0.0	2.1	7	10	122	0.83	0.3	0.5	1.2
20141224	1626	42.11	40.99	-78.50	1.3	1.7	7	18	122	0.84	0.3	0.5	2.1
20141229	1433	2.99	41.45	-75.57	0.1	2.0	9	16	89	0.51	0.3	0.3	99.0
20141230	1521	37.87	41.11	-78.32	0.1	1.8	6	21	107	0.56	0.3	0.4	99.0
20141230	1554	51.77	40.83	-76.03	0.0	1.5	5	24	136	0.76	0.4	0.6	99.0
20141230	1833	0.07	40.80	-78.32	2.6	1.6	6	13	186	0.17	0.3	1.0	5.0

Events located outside of Pennsylvania:

Date	hhmm	Sec:	Latitude	Longitude	Depth	Mag	N	D1	Gap	RMS	SEH	SEH	SEZ
20130204	1700	19.38	40.38	-80.89	7.3	2.1	5	47	185	0.77	0.3	1.0	0.9
20130204	2020	0.19	40.35	-80.68	1.5	2.3	6	32	115	0.84	0.3	0.6	2.3
20130212	1906	41.97	40.20	-81.24	12.3	2.3	7	7	196	0.51	0.3	1.1	0.6
20130219	1811	8.1	40.30	-80.95	12.7	1.8	5	23	174	0.06	0.5	0.7	1.1
20130219	1913	49.75	39.11	-80.38	37.4	2.6	8	145	262	0.55	0.6	2.4	33.3
20130221	2123	48.14	40.83	-81.23	0.0	2.3	18	33	127	0.92	0.2	0.4	0.5
20130222	1554	44.17	39.63	-80.05	4.3	2.1	11	23	67	0.57	0.3	0.3	0.6
20130222	1825	13.23	40.20	-80.96	0.0	2.5	15	22	84	0.89	0.3	0.3	0.7
20130301	1521	10.45	40.63	-80.95	0.0	2.4	4	22	143	0.10	0.5	0.7	99.0
20130301	1902	40.82	40.22	-81.11	7.7	2.1	10	9	81	0.84	0.3	0.3	0.5
20130304	1951	51.97	40.29	-80.71	0.0	2.4	20	31	85	0.78	0.2	0.3	0.5

20130312	1840	14.33	40.35	-80.93	10.9	2.6	14	26	116	1.07	0.3	0.4	0.6
20130313	2152	39.47	39.07	-80.38	4.9	2.2	13	27	149	0.92	0.3	0.4	0.5
20130317	2249	25.89	41.67	-80.91	0.0	2.0	15	32	171	0.86	0.3	0.5	0.5
20130319	1659	51.29	38.80	-81.20	17.5	2.3	7	79	263	0.36	0.5	2.1	1.0
20130320	2019	17.83	40.17	-81.09	0.0	2.3	12	13	75	1.01	0.3	0.4	0.8
20130321	1843	2.9	40.61	-80.97	12.5	2.4	7	25	152	0.53	0.3	0.6	0.8
20130321	1920	42.74	40.19	-81.21	9.6	2.3	16	6	100	0.64	0.3	0.3	0.5
20130322	1833	19.04	40.31	-81.05	10.2	2.6	12	15	134	1.09	0.3	0.5	0.7
20130323	1604	51.05	39.55	-81.55	0.1	2.3	12	15	221	0.81	0.3	0.8	0.5
20130325	1951	8.81	40.10	-81.09	4.6	2.5	21	20	71	0.64	0.2	0.3	0.5
20130326	1301	27.63	40.31	-81.10	0.0	2.4	5	11	130	0.06	0.3	0.5	99.0
20130326	1415	51.78	40.31	-81.48	20.1	2.5	5	24	169	0.28	0.5	1.4	1.0
20130327	1945	17.1	40.37	-81.12	0.0	2.5	10	16	132	0.79	0.3	0.4	0.9
20130327	2014	50.61	39.66	-78.90	11.4	2.5	13	48	217	0.78	0.3	0.8	0.5
20130329	1949	16.22	40.06	-81.11	0.0	2.3	21	23	75	0.93	0.2	0.3	0.5
20130401	1945	16.57	40.06	-81.22	5.5	2.5	13	21	171	0.53	0.3	0.5	0.6
20130402	1550	11.34	40.12	-81.10	0.0	1.9	12	17	134	0.52	0.3	0.5	0.7
20130402	2007	44.45	40.42	-81.15	0.0	2.4	15	19	138	1.13	0.3	0.4	0.7
20130403	1652	43.57	39.62	-78.90	3.5	2.3	10	52	221	0.45	0.3	1.0	0.6
20130404	1853	12.89	39.65	-78.95	1.2	2.5	14	69	180	0.47	0.3	0.6	0.6
20130405	1721	14.76	40.42	-80.92	0.1	2.1	6	31	122	0.53	0.4	0.4	1.1
20130406	1551	25.94	40.11	-81.05	3.2	1.8	5	20	133	0.25	0.4	0.7	1.0
20130409	1942	54.46	40.28	-81.08	0.0	2.5	7	12	124	0.43	0.4	0.5	99.0
20130416	1816	39.04	40.28	-81.09	0.7	2.2	9	10	120	0.52	0.3	0.4	0.9
20130420	1638	32.76	40.33	-80.70	2.9	2.0	15	32	91	1.08	0.3	0.3	0.6
20130422	1706	3.03	39.71	-78.96	3.0	2.6	13	46	198	0.39	0.3	0.7	0.5
20130424	1534	39.96	39.68	-78.92	7.6	2.5	14	47	180	0.70	0.3	0.6	0.6
20130425	1601	18.22	39.67	-79.71	12.1	2.0	10	20	148	0.28	0.3	0.5	0.7
20130430	1824	46.95	40.11	-80.97	6.3	1.9	10	25	189	0.73	0.4	0.7	0.5
20130430	1838	16.88	40.26	-80.96	5.8	2.3	12	22	125	0.91	0.3	0.4	0.6
20130501	1519	21.42	39.51	-79.02	4.5	2.6	16	68	209	0.48	0.3	0.7	0.5
20130501	1959	51.77	39.69	-78.83	7.9	2.3	8	43	283	0.89	0.8	2.3	1.1
20130501	2009	25.74	39.63	-78.92	3.1	2.2	18	51	145	0.65	0.2	0.4	0.5
20130502	1804	9.98	40.20	-81.11	13.5	2.2	13	10	75	0.96	0.3	0.3	0.5
20130506	1423	39.71	39.64	-78.95	6.5	2.5	24	53	156	0.86	0.2	0.4	0.4
20130507	1527	39.53	39.69	-78.93	1.8	2.5	15	47	154	0.77	0.3	0.5	0.5
20130508	1724	54.94	40.23	-80.95	6.7	2.3	10	22	120	0.34	0.3	0.4	0.5
20130508	1804	38.46	40.24	-81.07	3.7	2.3	11	12	99	0.80	0.3	0.4	0.6
20130508	2004	17.43	39.59	-75.79	0.0	1.7	7	28	272	0.91	0.5	2.1	1.8
20130510	1558	34.28	39.51	-76.70	0.0	1.9	10	26	229	0.64	0.4	1.0	0.7
20130510	1758	47.9	40.20	-80.92	4.0	2.3	10	25	107	0.72	0.3	0.4	0.6
20130511	1546	18.58	40.19	-81.07	0.0	2.0	12	13	138	0.93	0.3	0.4	0.6
20130513	1947	48.61	40.34	-81.17	1.6	2.3	8	11	181	0.62	0.4	0.8	0.7
20130514	1601	18.47	40.22	-80.93	7.5	2.3	9	24	148	0.21	0.3	0.5	0.6
20130515	1612	25.47	40.22	-80.96	3.7	2.5	15	22	149	0.90	0.3	0.5	0.5
20130516	1358	33	40.29	-81.16	7.1	2.6	7	6	181	0.77	0.6	0.7	0.6
20130516	1816	58.13	40.29	-81.14	11.4	2.2	8	8	153	0.97	0.5	0.7	0.7
20130516	2000	7.73	40.33	-81.04	3.8	2.3	14	16	126	1.40	0.3	0.3	0.6
20130516	2002	43.62	40.81	-81.10	1.2	2.4	11	22	145	0.83	0.3	0.5	0.6
20130517	1602	17.92	40.16	-80.92	0.6	2.3	10	27	166	0.83	0.3	0.6	0.6

20130520	1812	29.51	40.19	-80.96	4.9	2.5	15	22	117	0.76	0.3	0.4	0.6
20130520	2043	44.7	40.69	-81.05	3.3	2.5	15	22	128	0.94	0.3	0.4	0.5
20130521	1237	7.43	39.61	-78.97	5.4	2.3	10	56	248	0.39	0.5	1.4	0.8
20130521	1942	6.44	40.31	-81.24	12.6	2.7	12	7	215	0.57	0.3	0.7	0.4
20130521	1949	33.11	40.18	-80.93	2.7	2.6	17	25	160	0.77	0.3	0.5	0.5
20130521	2119	33.42	40.33	-80.77	5.0	2.0	12	36	100	0.89	0.3	0.4	0.6
20130522	1652	1.38	40.38	-80.67	0.0	2.1	7	25	146	0.87	0.4	0.5	1.2
20130522	1806	49.3	40.20	-80.96	7.7	2.6	16	22	85	0.73	0.3	0.3	0.5
20130522	1944	31.52	40.32	-81.01	4.5	2.7	9	18	129	0.99	0.3	0.4	1.0
20130523	2001	45.75	40.27	-80.71	0.2	2.1	4	30	137	0.10	0.4	0.6	99.0
20130523	2007	37.73	40.72	-81.07	3.5	2.4	17	22	141	0.73	0.3	0.4	0.5
20130524	1805	57.45	40.07	-81.06	2.1	2.4	21	23	124	0.82	0.2	0.3	0.5
20130528	1527	27.62	40.94	-80.88	3.5	2.3	27	15	183	0.85	0.2	0.5	0.4
20130528	1945	47.96	40.18	-80.94	0.1	2.5	23	25	82	0.92	0.2	0.3	0.5
20130528	1947	18.8	40.28	-81.10	0.0	2.7	25	10	102	0.79	0.2	0.3	0.4
20130528	2018	46.91	40.82	-81.01	0.0	2.3	24	14	113	0.81	0.3	0.3	0.4
20130529	1530	26.86	39.56	-78.88	0.0	2.1	7	7	123	0.48	0.3	0.4	99.0
20130530	1842	52.21	40.44	-80.58	1.3	2.4	14	15	80	1.19	0.2	0.4	0.6
20130531	1705	27.8	40.21	-80.93	2.9	2.2	14	24	130	0.54	0.3	0.5	0.5
20130531	1834	53.13	40.14	-81.05	16.2	2.4	7	19	100	0.46	0.4	0.7	1.9
20130531	1947	37.93	40.30	-81.06	0.6	2.5	23	14	124	0.91	0.3	0.3	0.5
20130612	1652	28.71	40.19	-80.94	7.1	2.5	12	24	158	0.66	0.3	0.5	0.5
20130614	1656	22.14	40.28	-80.68	0.0	2.1	7	27	154	0.60	0.4	0.5	0.9
20130614	1703	59.16	39.66	-78.86	0.0	2.0	7	18	154	0.36	0.4	0.6	0.7
20130617	1610	53.99	40.22	-80.92	1.9	2.4	17	25	89	0.90	0.3	0.3	0.5
20130623	1554	39.55	40.77	-74.42	0.0	2.1	16	58	182	0.97	0.3	0.5	0.6
20130624	1927	49.51	39.85	-80.65	4.8	2.1	14	18	86	0.68	0.3	0.3	0.5
20130629	1402	28.41	39.52	-78.91	6.0	2.0	10	6	96	0.79	0.3	0.5	0.6
20130629	1452	53.9	40.22	-80.91	0.1	2.4	20	52	84	0.83	0.2	0.3	0.5
20130702	1624	38.78	39.34	-77.45	0.0	1.6	6	21	134	0.18	0.3	0.5	99.0
20130704	1700	58.42	40.20	-80.89	7.2	2.3	14	28	83	0.91	0.3	0.3	0.5
20130708	1802	44.02	40.24	-81.06	2.6	2.3	9	13	101	0.57	0.3	0.4	0.7
20130708	1946	43.12	40.15	-80.90	5.9	2.2	13	29	118	0.92	0.3	0.4	0.5
20130708	1947	39.09	40.27	-81.17	6.9	2.7	7	4	164	0.46	0.6	0.9	0.7
20130708	1955	15.88	40.35	-81.08	0.0	2.5	7	15	133	0.15	0.3	0.5	99.0
20130719	1629	28.58	39.53	-76.64	0.0	1.7	13	20	196	0.54	0.2	0.6	0.7
20130719	1851	33.75	39.66	-78.19	1.5	1.7	12	25	60	0.44	0.2	0.3	1.2
20130719	1936	9.44	39.90	-81.64	36.7	2.3	10	54	304	1.44	0.9	6.1	0.8
20130719	2154	57.7	40.28	-80.68	0.0	2.2	10	28	99	0.84	0.3	0.4	0.8
20130723	1732	8.09	40.88	-74.49	0.0	2.4	20	51	168	0.92	0.3	0.4	0.5
20130724	1944	16.98	40.18	-80.92	0.1	2.8	22	26	80	0.90	0.3	0.3	0.5
20130726	1802	12.76	40.22	-80.96	2.3	2.5	12	21	166	0.58	0.4	0.5	0.7
20130730	1625	3.86	40.31	-81.06	0.0	2.7	21	14	122	0.85	0.3	0.4	0.7
20130731	1501	33.98	40.90	-74.49	39.6	2.0	13	52	163	1.12	0.4	0.5	3.2
20130809	1602	54.77	39.71	-79.69	0.0	1.9	8	25	130	0.60	0.3	0.5	1.3
20130822	1632	51.17	40.89	-74.44	0.0	2.3	13	55	275	0.70	0.5	2.0	0.9
20130917	2104	18.99	40.32	-80.60	12.3	2.1	5	24	131	0.03	0.4	0.6	1.6
20131003	1430	32.96	40.95	-74.55	0.0	1.5	11	31	122	0.30	0.3	0.4	0.9
20131003	1514	52.56	40.60	-74.56	0.0	2.1	15	28	186	0.46	0.3	0.5	0.6
20131025	1612	42.14	39.62	-78.90	1.3	2.6	38	14	57	0.97	0.2	0.2	0.3

20131028	1608	5.06	39.71	-79.74	0.0	1.9	9	24	76	0.49	0.3	0.4	1.0
20131028	1730	5.65	40.91	-74.53	0.0	2.3	15	27	97	0.74	0.3	0.3	0.6
20131028	1951	50.85	39.71	-78.86	0.0	2.5	36	23	78	0.82	0.2	0.2	0.3
20131111	1953	20.53	39.88	-80.62	6.8	2.0	8	15	78	0.60	0.3	0.3	0.9
20131115	2145	7.78	40.27	-80.74	0.0	2.3	6	32	139	0.72	0.3	0.5	99.0
20131127	1810	58.49	39.70	-78.84	0.6	2.5	29	23	53	0.63	0.2	0.2	0.4
20131204	2042	41.71	40.21	-80.97	1.7	2.4	15	21	87	0.51	0.3	0.3	0.6
20131209	2034	24.98	40.26	-80.68	0.0	2.0	6	28	102	0.62	0.3	0.4	99.0
20131220	1814	16.59	39.64	-78.20	0.0	2.0	27	24	46	0.77	0.2	0.2	0.4
20140102	1906	28.6	39.82	-81.25	0.0	2.2	6	60	172	0.45	0.3	0.6	1.0
20140103	2042	31.32	40.30	-81.07	2.4	2.5	5	59	232	0.18	0.5	1.5	0.9
20140105	1949	54.52	39.28	-77.79	0.1	1.7	11	29	105	0.44	0.3	0.4	0.6
20140106	1456	21.02	39.53	-78.86	2.8	1.9	7	4	126	0.39	0.3	0.7	0.6
20140110	1746	59.96	43.09	-76.35	0.0	2.2	16	42	211	0.58	0.3	0.7	0.5
20140110	1900	4.08	40.22	-81.16	12.1	2.1	5	5	191	0.38	0.5	1.0	0.8
20140110	2049	24.39	40.20	-81.10	0.2	2.4	6	10	116	0.52	0.4	0.6	1.0
20140111	1738	42.09	40.29	-80.73	0.1	2.0	6	32	129	0.47	0.4	1.0	4.3
20140117	1902	37.7	40.28	-81.10	4.3	2.7	13	10	125	0.40	0.3	0.5	0.6
20140120	650	20.13	41.34	-81.76	0.0	2.2	11	40	234	0.27	0.4	1.0	0.8
20140120	1440	32.3	39.52	-78.99	0.0	2.2	7	13	153	0.32	0.3	0.5	0.8
20140120	2010	24.91	40.82	-81.16	4.4	2.3	6	27	262	0.59	0.5	2.5	1.2
20140122	1850	24.82	40.75	-80.99	0.1	2.6	6	14	148	0.47	0.4	0.6	1.0
20140122	1909	9.91	40.25	-81.14	6.3	2.3	5	6	161	0.01	0.4	1.3	0.8
20140124	1705	4.93	40.33	-81.11	0.1	2.5	6	12	150	0.42	0.4	0.5	0.9
20140124	1731	24.94	39.55	-76.11	0.0	1.8	7	28	228	0.44	0.4	1.0	1.0
20140129	1551	33.96	39.68	-78.91	4.4	2.4	10	47	212	0.30	0.3	0.9	0.6
20140130	1418	26.2	40.08	-80.77	0.6	2.5	9	35	260	0.18	0.4	2.0	0.8
20140130	1637	30.36	39.63	-78.90	5.7	2.5	7	73	222	0.13	0.5	1.0	0.8
20140130	2106	50.34	40.88	-81.42	82.2	2.6	8	162	271	0.37	0.6	2.9	8.4
20140201	1653	18.62	40.85	-81.29	0.0	2.5	12	38	245	0.40	0.3	1.4	0.8
20140203	2053	28.54	40.23	-81.01	0.0	1.7	6	17	181	0.41	0.4	1.2	1.1
20140203	2134	20.83	40.91	-81.02	2.4	2.5	7	87	309	0.76	1.1	4.7	2.4
20140204	2050	58.67	39.60	-78.87	2.2	2.3	12	11	97	0.32	0.4	0.4	0.5
20140205	2044	58.95	40.24	-81.17	7.4	2.5	9	4	103	0.45	0.4	0.6	0.6
20140208	1626	44.75	40.91	-80.99	6.2	2.0	7	16	128	0.26	0.4	0.5	1.2
20140212	1700	36.41	40.17	-80.97	5.4	2.5	5	22	203	0.47	0.5	1.3	1.1
20140215	1540	36.82	39.45	-78.97	0.6	2.0	14	12	84	0.48	0.3	0.3	0.6
20140217	1924	4.44	40.27	-81.09	7.0	2.7	8	11	146	0.45	0.5	0.7	1.1
20140218	1555	47.4	39.53	-77.18	4.1	1.9	5	12	177	0.04	0.4	1.0	1.3
20140218	1603	17.13	40.28	-80.69	21.9	1.9	5	29	136	0.23	0.5	0.6	0.8
20140218	1745	49.96	39.60	-78.90	6.7	2.2	5	55	178	0.33	0.4	0.9	0.9
20140220	2048	16.96	39.65	-78.18	0.0	2.4	19	24	81	0.64	0.2	0.3	0.5
20140221	1650	53.94	39.69	-79.75	1.8	1.8	6	9	128	0.29	0.4	0.7	1.1
20140221	1901	39.73	40.00	-81.13	0.2	2.6	5	28	180	0.36	0.4	0.9	1.0
20140226	1443	44.58	40.08	-80.93	15.3	2.3	4	48	220	0.00	0.5	2.8	2.4
20140226	1803	3	40.96	-74.59	0.0	2.0	6	44	228	0.25	0.4	1.1	1.6
20140228	1723	10.93	39.70	-79.71	1.9	1.6	7	24	134	0.65	0.3	0.6	1.2
20140305	1859	10.99	40.24	-81.12	9.8	2.6	9	8	143	0.35	0.3	0.5	0.6
20140314	1949	13.87	40.21	-81.08	2.7	2.8	7	12	146	0.45	0.4	0.6	0.7
20140318	1429	38.44	39.51	-78.92	6.1	2.5	9	7	249	0.32	0.7	1.2	0.6

20140318	1846	0.5	39.48	-76.71	21.4	1.7	7	51	167	0.21	0.4	0.6	4.0
20140321	1853	14.66	40.05	-81.02	0.0	2.6	5	28	234	0.34	0.5	1.7	0.9
20140324	1610	34.78	39.72	-79.72	0.1	2.2	4	12	168	0.22	0.4	0.9	99.0
20140324	1954	28.75	40.28	-80.94	0.0	2.6	10	23	136	0.73	0.4	0.6	1.1
20140327	1730	27.85	39.08	-77.19	24.8	1.6	6	45	202	0.37	0.5	1.1	0.7
20140402	1901	33.51	39.20	-80.14	0.0	2.2	11	23	103	0.44	0.3	0.4	0.7
20140405	1515	49.48	39.41	-78.95	0.0	2.1	6	13	213	0.76	0.4	1.9	1.6
20140407	1457	44.52	39.64	-78.79	1.8	2.5	8	16	138	0.31	0.3	0.5	0.8
20140408	1542	45.18	39.36	-78.70	29.0	2.2	5	20	280	0.25	0.9	1.8	0.6
20140503	1721	49.72	40.79	-81.21	0.0	2.4	7	31	212	0.34	0.4	1.0	0.7
20140521	1420	44.14	39.23	-78.33	0.0	2.0	4	22	105	0.03	0.4	0.5	33.3
20140610	1631	47.44	40.30	-80.66	2.6	2.0	5	28	187	0.73	0.4	1.0	1.4
20140610	1813	29.22	39.48	-76.39	5.7	2.2	5	15	211	0.32	0.4	1.0	1.3
20140625	1736	54.99	40.20	-80.57	0.0	2.0	9	17	104	0.28	0.3	0.3	99.0
20140626	1645	53.39	40.26	-80.77	0.5	2.1	9	35	107	0.19	0.3	0.4	2.1
20140701	1630	6.32	40.97	-74.22	10.8	2.0	9	25	209	0.26	0.4	0.9	0.6
20140701	2038	23.09	39.71	-76.12	0.0	1.8	6	28	173	0.32	0.3	0.6	99.0
20140707	2044	14.5	38.75	-81.51	3.4	2.2	7	64	285	0.66	0.7	2.7	1.3
20140709	1801	54.46	40.22	-81.13	0.0	2.3	8	8	124	1.07	0.3	0.4	2.2
20140711	1437	23.31	39.52	-79.04	0.0	2.9	7	18	231	0.44	0.7	3.6	3.7
20140711	1645	12.57	38.39	-81.39	36.0	2.4	7	82	275	0.91	0.7	3.0	33.3
20140711	2002	0.83	37.98	-80.95	30.0	2.6	13	172	286	1.96	0.7	3.4	33.3
20140714	1806	7.78	40.29	-80.94	0.1	2.6	7	24	139	0.15	0.4	0.9	1.5
20140715	1601	50.6	40.15	-80.98	0.0	2.6	7	22	213	1.00	0.4	3.1	1.2
20140716	1601	32.44	40.23	-80.98	6.9	2.4	10	20	95	0.64	0.3	0.4	0.7
20140724	1532	16.24	39.62	-78.22	0.0	1.9	9	24	127	0.91	0.3	0.4	1.0
20140725	1400	2.14	40.79	-74.32	13.5	2.0	7	5	144	0.46	0.4	0.8	0.7
20140730	1814	37.39	39.40	-76.38	0.0	2.7	16	24	223	1.41	0.3	0.9	0.5
20140808	1507	20.49	39.48	-79.03	0.0	2.3	32	17	193	0.70	0.2	0.4	0.5
20140811	1601	50.55	39.71	-79.82	0.0	1.8	5	23	81	0.62	0.4	0.4	99.0
20140813	1600	26.52	39.40	-76.24	0.0	2.3	13	28	226	0.59	0.3	0.8	0.6
20140815	1424	37.22	39.62	-78.90	0.0	2.1	6	14	103	0.80	0.4	0.4	99.0
20140821	1940	37.84	39.84	-80.77	0.0	2.0	5	29	166	0.85	0.4	0.6	99.0
20140826	1641	42.43	39.44	-76.32	0.0	2.2	11	21	217	0.55	0.3	0.7	0.8
20140826	2007	51.85	39.63	-79.15	14.6	2.2	8	60	184	0.85	0.5	0.8	1.0
20140827	1600	4.51	40.25	-74.49	0.0	2.3	9	79	240	0.58	0.4	1.3	0.9
20140915	1602	2.49	40.28	-80.95	8.7	2.0	5	22	158	0.08	0.4	0.6	0.8
20140917	1558	35.02	39.68	-79.81	0.0	1.7	4	18	133	0.53	0.4	0.5	99.0
20140918	1547	39.97	38.35	-81.26	35.3	2.5	9	80	274	0.48	0.6	2.7	33.3
20140923	1600	10.04	40.23	-74.41	36.0	2.3	8	86	244	1.50	0.5	1.7	33.3
20141006	1806	24.83	40.06	-80.84	25.3	1.8	7	38	156	0.57	0.4	0.6	0.8
20141006	1824	9.67	41.63	-74.53	0.1	2.1	6	34	86	0.52	0.3	0.4	99.0
20141006	2142	57.79	39.09	-80.31	8.2	2.1	9	23	137	0.80	0.4	0.5	0.8
20141013	1359	10.11	41.30	-74.97	0.0	1.7	9	21	109	0.32	0.3	0.4	99.0
20141016	1400	8.63	40.34	-75.08	15.3	1.7	6	16	141	0.19	0.5	0.9	2.3
20141024	1424	13.86	40.28	-80.68	0.0	1.8	7	27	130	0.29	0.3	0.4	2.3
20141024	1851	10.24	41.63	-74.87	0.1	1.9	7	40	95	0.57	0.3	0.4	99.0
20141029	1521	58.08	40.19	-80.65	4.0	2.1	8	23	112	0.45	0.3	0.4	1.1
20141106	1455	12.91	40.73	-75.12	0.0	1.6	7	16	177	0.79	0.3	0.6	99.0
20141201	1600	6.27	39.69	-78.88	0.0	99.0	6	44	291	0.50	0.7	3.5	1.7

20141208	1600	20.82	40.71	-75.19	0.0	1.6	8	19	146	0.19	0.3	0.4	99.0
20141212	1530	6.54	40.21	-75.30	0.0	1.4	5	15	123	0.11	0.4	0.5	99.0
20141224	1621	23.27	39.70	-77.52	0.0	1.6	7	48	145	0.28	0.3	0.5	2.3

Appendix D: Selected spectra from Figures 2.4 and 2.5

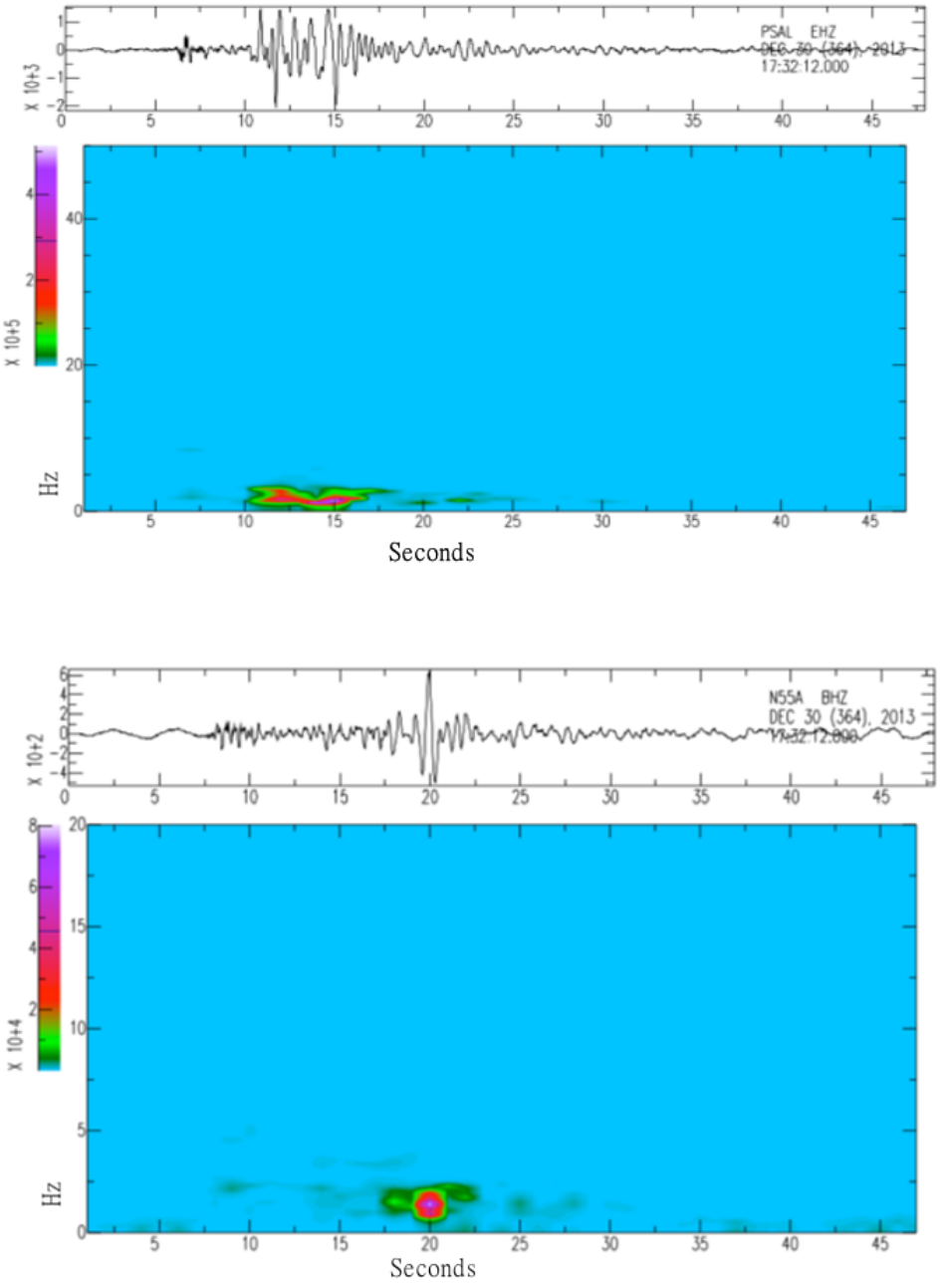


Figure A1: Computed spectra for the December 30, 2013 blasting event from the two nearest stations.

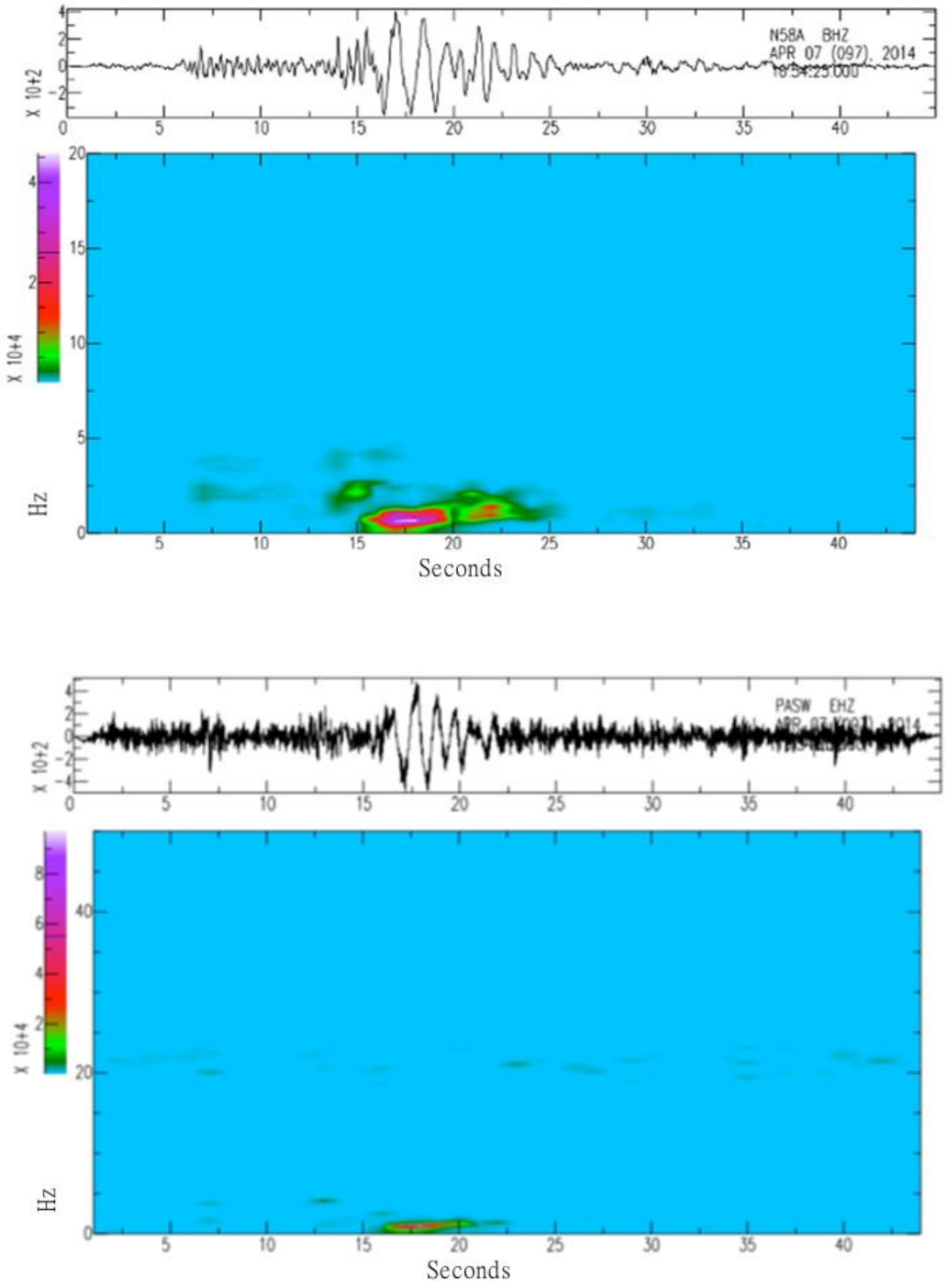


Figure A2: Computed spectra for the April 7, 2014 blasting event from the two nearest stations.

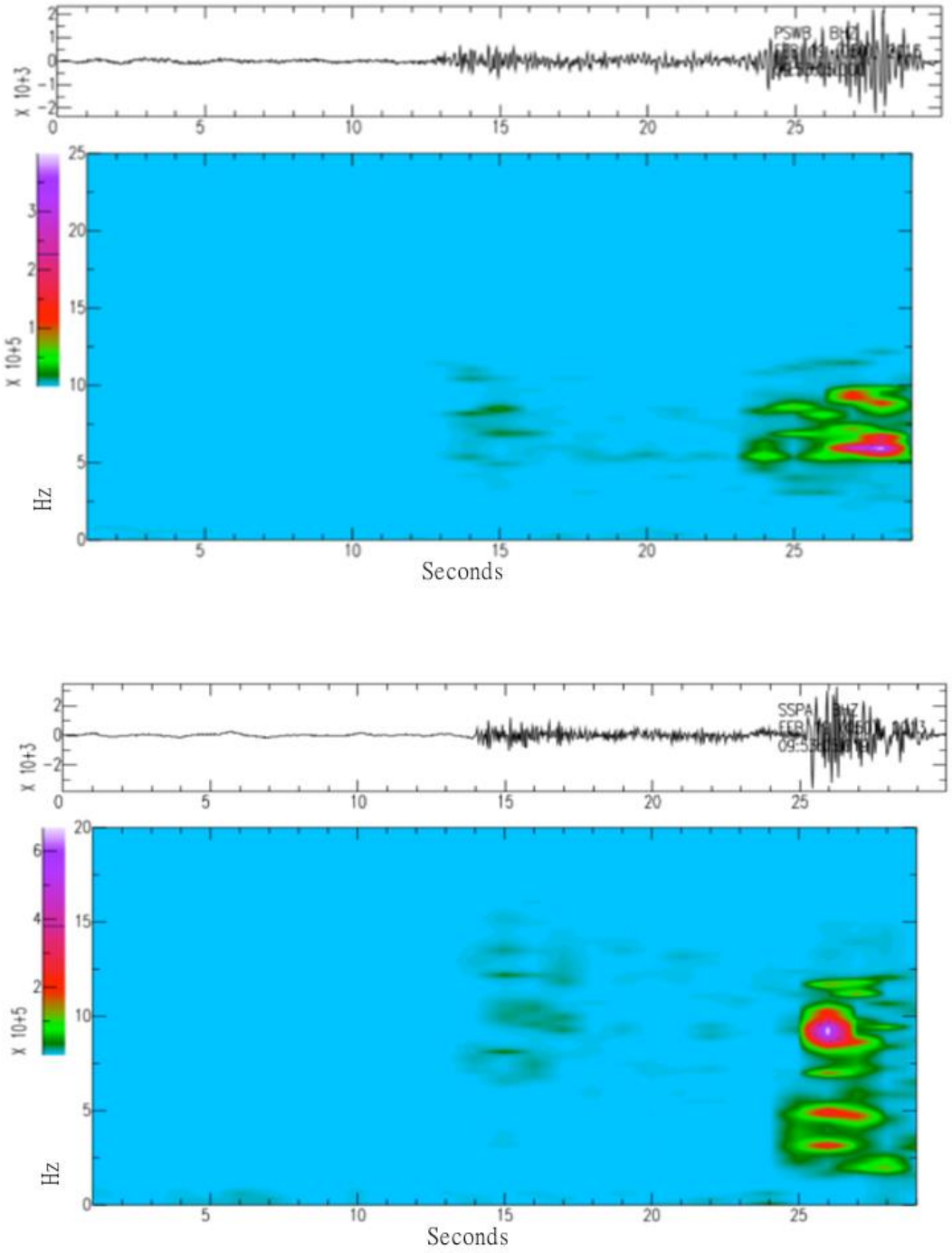


Figure A3: Computed spectra for the February 19, 2013 non-mining event from the two nearest stations.

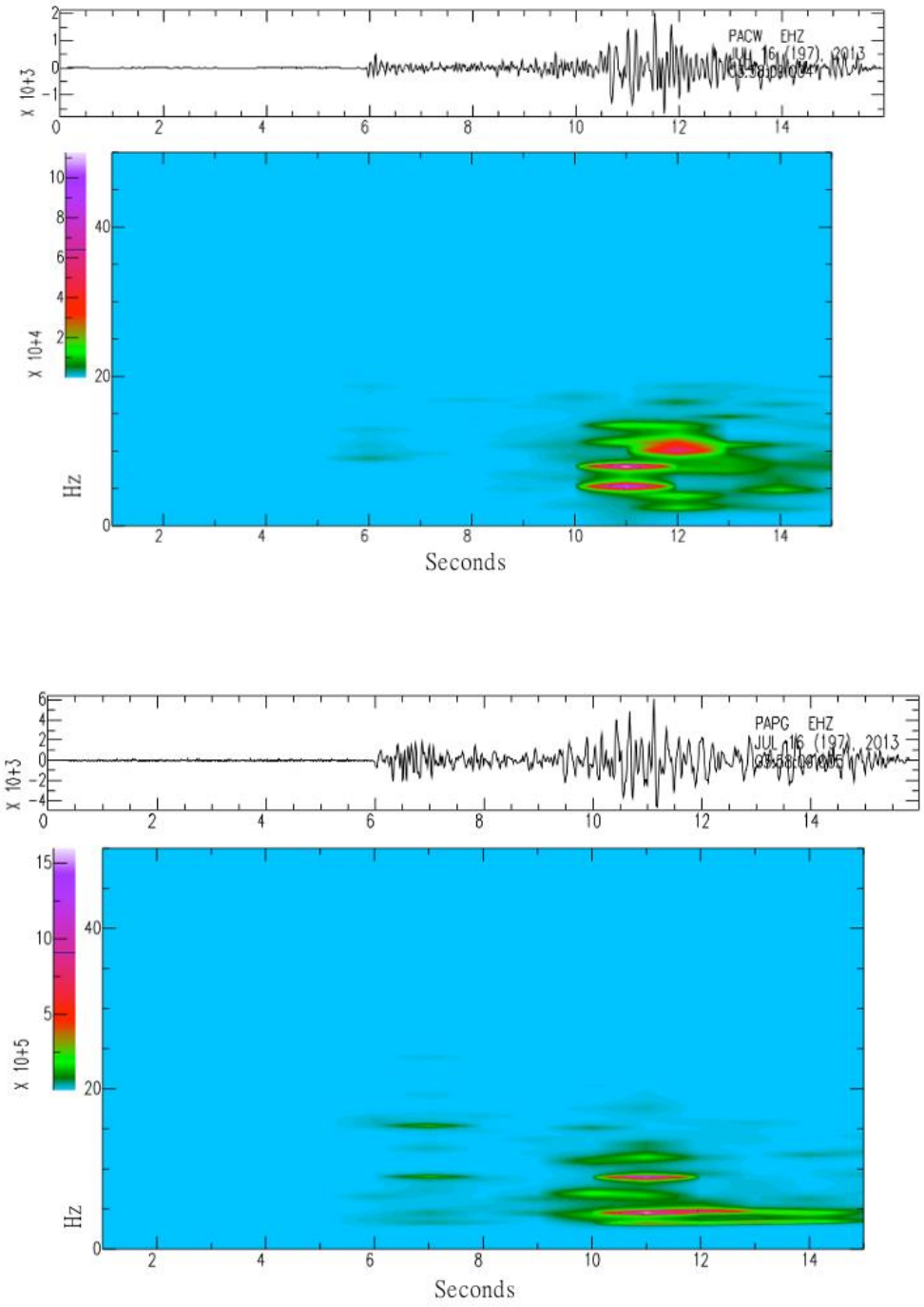


Figure A4: Computed spectra for the July 16, 2013 non-mining event from the two nearest stations.