Aftershock Relocations of the 2008 Mt. Carmel Earthquake Sequence

5/13/2009

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Abstract

On April 18, 2008, a significant earthquake of magnitude (Mw) 5.2 occurred along the Indiana-Illinois state border at the northern bound of the Wabash Valley fault system, near the Mt. Carmel-New Harmony fault trace. A total of 257 aftershocks were recorded over the next two months by three temporary arrays containing fourteen stations surrounding the main shock's epicenter deployed by Indiana University and University of Memphis. The number of aftershocks is considerably greater than aftershocks than recorded from previous earthquakes in the last 50 years. The number of local stations allowed the generation of precise hypocentral locations. We used a number of seismic analytical programs to produce precise relocations of the earthquake sequence. Our relocated events clearly indicate a vertical fault plane striking east-west. The orientation is consistent with the focal mechanism of the main shock, but perpendicular to the known fault trace of the Mt. Carmel-New Harmony fault. This suggests the event sequence occurred along a transfer structure between NE-SW trending structures.

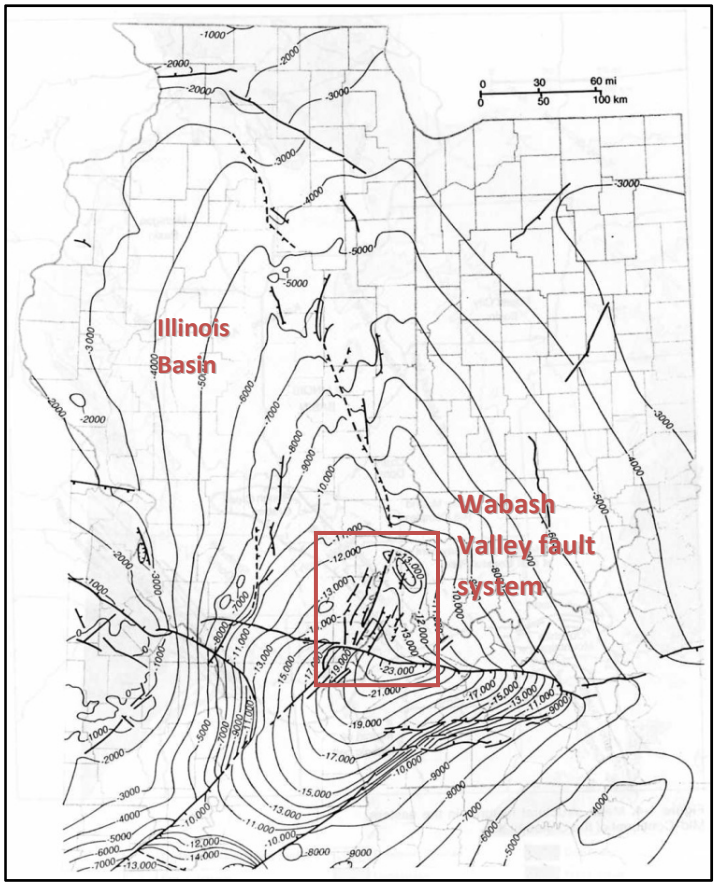

Figure 1: Map of Illinois Basin. Highlighted rectangle indicated position of the WVFS. Modified from Buschbach and Kolata (1990)

Introduction

The Wabash Valley fault system (WVFS) is positioned within the structurally complex region within the southern Illinois Basin, which is a major cratonic basin on the North American plate (Buschbach and Kolata, 1990). The Illinois Basin contains Paleozoic stratigraphy over a presumed igneous, crystalline basement. The origin of the faulting is unknown but it has been proposed to be the northern branch of a failed rift complex which occurred during the late Precambrian to early Cambrian, consisting of the Reelfoot rift and the Rough Creek graben (Braile, 1982). The Reelfoot rift is associated with the New Madrid seismic zone (NMSZ). The recent seismicity has led to discussions about any potential structural relationships between WVFS and NMSZ, as well as the possibility that there is a genetic relationship between earthquakes in each region (Braile, 1997; Hildenbrand and Ravat, 1997).

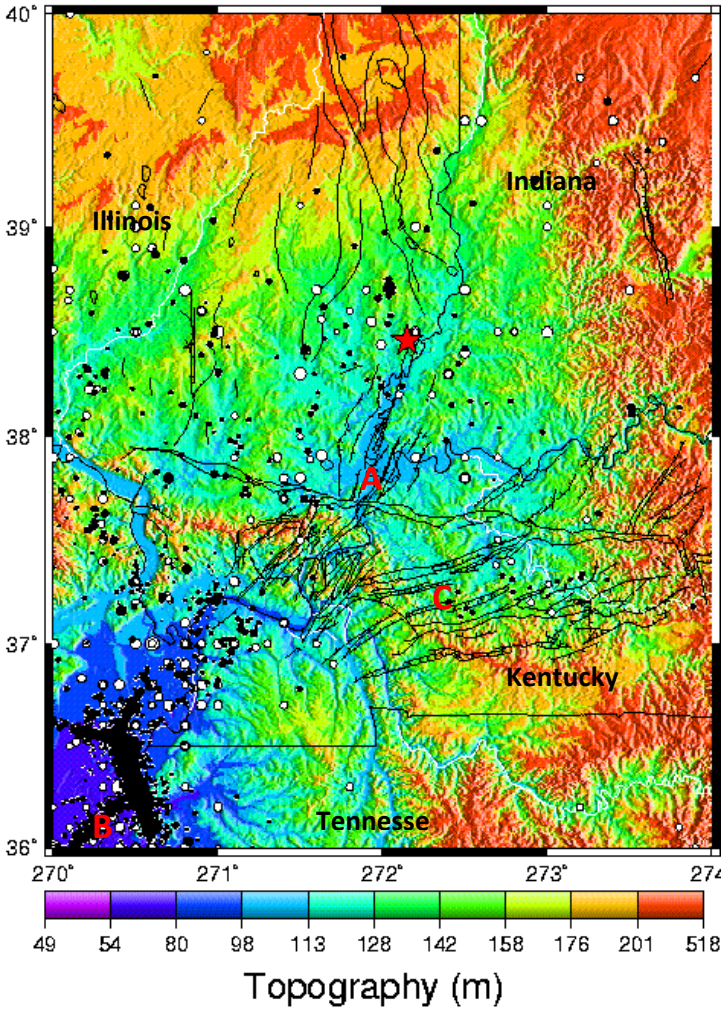

Figure 2: Map of Topography of Illinois Basin. Star indicates location of earthquake sequence; (A), WVFS; (B), NMSZ; (C), Rough Creek Graben. White circles are prehistoric earthquakes, black circles are historic events. Data provided by Nuttli Catalogue and Central Mississippi Valley Seismic Network.

The Wabash Valley fault system is a series of parallel normal high angle faults which trend north-north east,

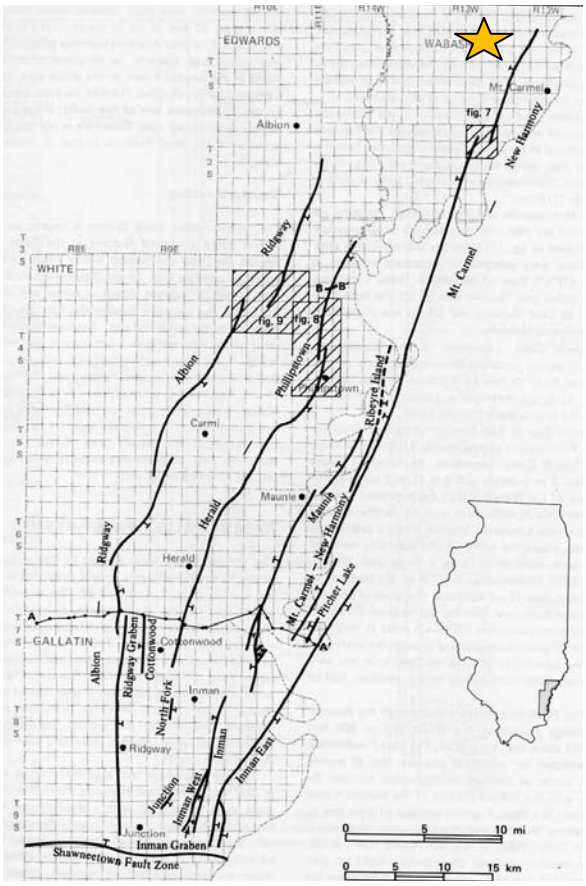

Figure 3: Magnified view of the WVFS. Gold Star indicates location of event cluster. East fault: Mt. Carmel-New Harmony. Modified from Bristol and Treworgy (1979)

covering an area of approximately 25 km^2 (Bristol and Treworgy, 1979). Maximum displacement on the faults is about 150 meters. The faults cut through the Pennsylvanian bedrock, which indicates activity after Pennsylvanian and prior to Pleistocene (290 - 1.9 My) (Bristol and Treworgy, 1979). The 2008 event sequence occurred at the north end of the Mt. Carmel-New Harmony fault trace. Despite the location of WVFS within the midcontinent plate where tectonic deformation rates are negligible (Buschbach and Kolata, 1990), this is a seismically active region where four significant earthquakes have occurred over the last fifty years, each originating within the basement (Kim, 2003; Taylor et al, 1989; Stauder and Nuttli, 1970). What is the mechanism behind the recent seismicity? There is not a large amount of visible faulting at the surface, partly due to the location of the WVSZ within the Illinois Basin, which has been filled with Paleozoic strata, as well as unconsolidated sediment related to recent periods of glaciations. Some subsurface imaging has indicated near vertical faulting evident within the sedimentary layers and extending into the basement (McBride *et al.*, 1997; Bear *et al.*, 1997). The recent earthquake sequence prompted many questions on different scales.

1. We assume that earthquakes are produced by ruptured fault planes. If this is true, what is the orientation of the ruptured fault plane which produced the 2008 earthquake sequence? How is this fault plane oriented in relation to the known Wabash Valley faults which trend north-south? What is

the fault plane's orientation the Mt. Carmel-New Harmony fault trace, which is only a few kilometers from the main shock?

2. What is the source of these fault ruptures? Are the events within the WVSZ genetically related the seismicity in the New Madrid Seismic Zone or northern Illinois?
3. Why is there seismic activity occurring within the tectonically stable North American plate?
4. What type of seismic activity can be expected in the future? What areas are most at risk for seismic activity? How can the public be prepared?

Our research focuses on the first set of questions. The Mt. Carmel earthquake sequence was significant for two reasons: the large number of aftershocks and the temporary arrays which the University of Memphis and Indiana University placed around the event cluster. The number of local stations allowed for precise hypocentral locations to be generated using a number of seismic analysis programs, and the number of events provides enough data to recreate an image of the fault plane.

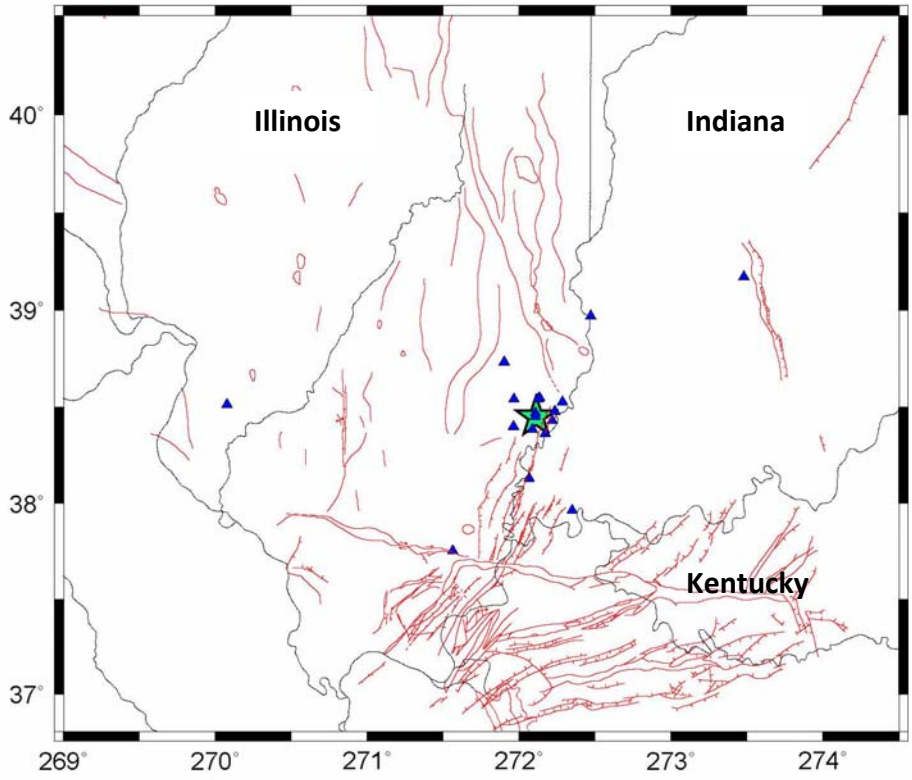

Figure 4: Regional map of seismic stations. Star indicates earthquake cluster. Small blue triangles represent seismic recording stations.

Data

The main shock was recorded by 7 regional stations and one station within 10 km of the main shock. After the earthquake, three temporary arrays were placed within 25 km of the cluster by University of Memphis and Indiana University. The University of Memphis

Recording Stations

Table 1: List of recording stations. IU1-6, MC1-5, and MCG stations were temporary arrays. Indiana University's temporary array contained 6 vertical component seismometers

Code	Location	Latitude	Longitude	Elevation (m)
BLO	Bloomington, IN	39.1718°N	86.5222°W	246.0m
BVIL	SW Illinois College Belleville, IL	38.5137°N	89.9240°W	489.0m
EVIN	University of Evansville Evansville, IN	38.9717°N	87.5297°W	140.0m
HAIL	SE Illinois College Harrisburg, IL	37.7526°N	88.4370°W	123.0m
IU1	Henson, IL	38.5415°N	88.0343°W	120m
IU2	Albion, IL	38.3997°N	88.0385°W	120m
IU3	Allendale, IL	38.5273°N	87.7153°W	134m
IU4	Bellmont, IL	38.3860°N	87.9118°W	117m
IU5	Lancaster, IL	38.5482°N	87.8653°W	132m
IU6	Mt. Carmel, IL	38.4698°N	87.8927°W	113.0m
MC1	Near USGS mainshock	38.4527°N	87.8923°W	113.0m
MC2	Between Bellmont and Maud	38.5437°N	87.8740°W	126.0m
MC4	Near Browns, IL	38.3632°N	87.8302°W	128.0m
MC5	Near Patton, IL	38.4798°N	87.7665°W	136.0m
MCGC	Mainshock array	38.4527°N	87.8923°W	113.0m
MCGE	Mainshock array	38.4527°N	87.8923°W	113.0m
MCGN	Mainshock array	38.4527°N	87.8923°W	113.0m
MCGS	Mainshock array	38.4527°N	87.8923°W	113.0m
NHIN	New Harmony, IN	38.1303°N	87.9360°W	90m
OLIL	Olney Central College Olney, IL	38.7338°N	88.0992°W	150m
USIN	University of Southern Indiana Evansville, IN	37.9650°N	87.6527°W	171.0m
WVIL	Wabash Valley College Mt. Carmel, IL	38.4298°N	87.7817°W	160.0m

had two arrays; both contained four stations with three component seismometers.

Stations MC1-5 were placed surrounding the cluster, and stations MCGC/E/N/S were later placed in close proximity to each other and MC1 at the USGS's main shock location. These four stations were designed as a phase array for detecting low-magnitude events. Indiana University placed six vertical component-only seismometers surrounding the cluster with IU6 located near the USGS's location for the main shock. There were fifteen local stations recording and seven regional stations.

We received the data from the three sets of station arrays compiled by analysts from the University of Memphis. The data we received did not contain all of the seismograms from every station for the entire recording period. The data contained the seismograms that recorded the events; some of the later events were low-magnitude and not detected by the regional stations. In these cases, only the seismograms from local stations were received. Therefore, the low magnitude events were located with the data from primarily the local stations. Over the course of the two months, some of the equipment encountered different technical problems, from problematic timing to instrument damage caused by a lightning strike. The data from NHIN appeared to have digital recording errors, and it also was not used for all of the relocations. We noted the presence of emergent waveforms which appeared

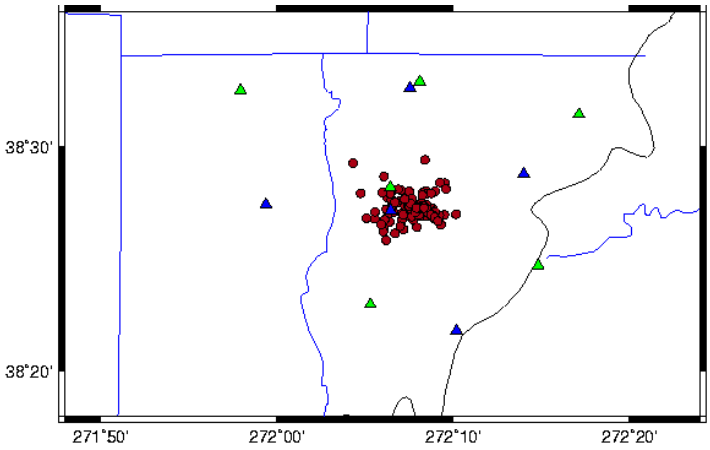

Figure 5: Map of local stations. Blue triangles represent CERI stations; green triangles, IU stations

primarily with the P arrival on local stations caused difficulty in producing well constrained hypocentral locations, which will be discussed later.

Method

During the first stage, we used a program *dbpick* to refine the P and S arrival times determined

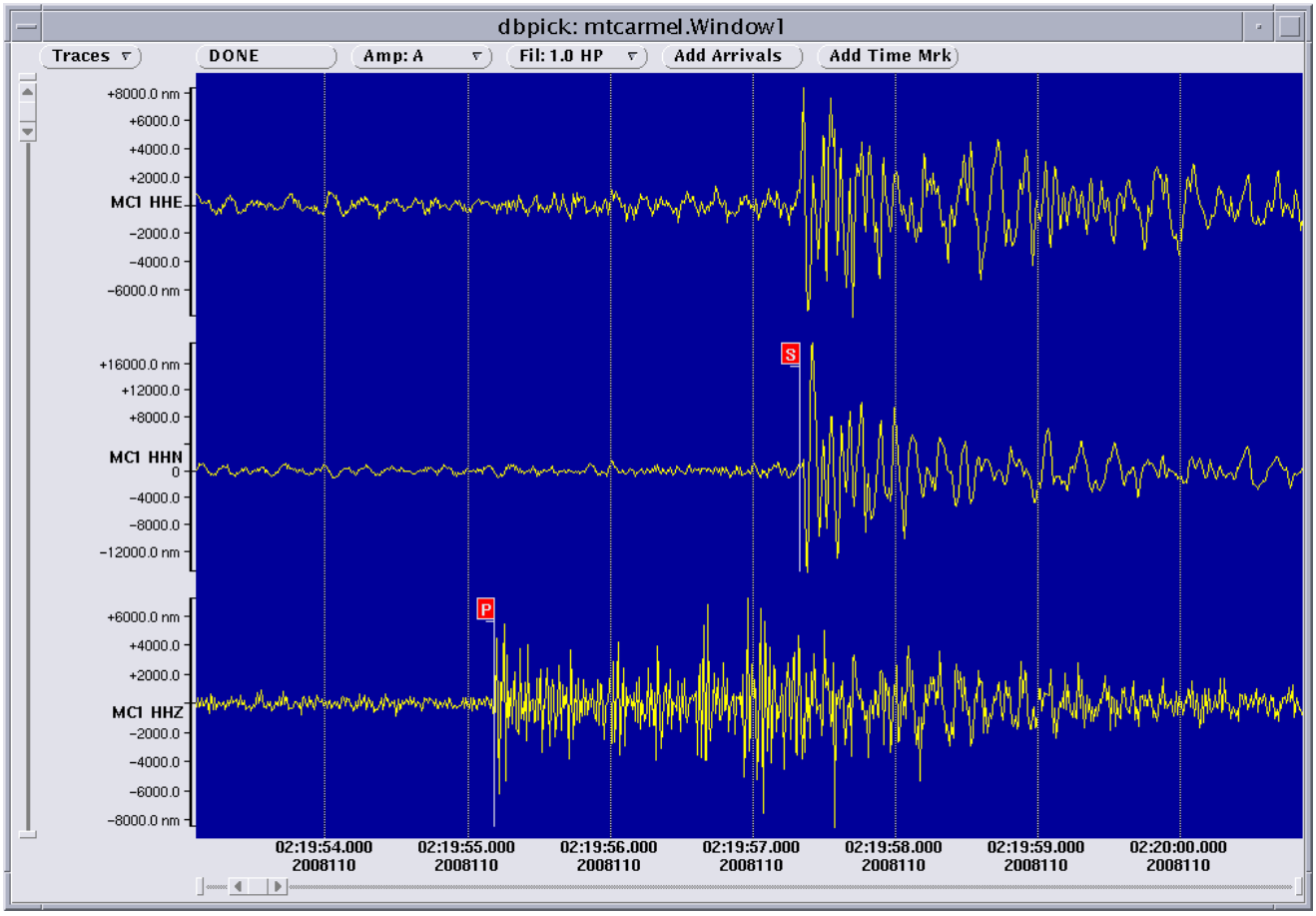

Figure 6: Screen shot of dbpick. Digital seismogram recorded from station MC1.

by CERI and the University of Memphis (www.brtt.com). *dbpick* is an interactive program that allows the user to select arrival times on digital seismograms. We chose a 1 Hz high pass filter on the data collected from local stations and a 1-5 Hz band-pass filter on the data from the regional stations. The arrival times I chose were what I judged to be the first break of the waveform. The lower magnitude events tended to have poor signal-to-noise ratios and had large errors. The S arrivals selected on the stations with only the vertical component had large errors because the S arrival is not expressed with significant vertical motion because the waveform is shear.

Next, we generated single event locations with the refined P and S arrival times with *dbloc2* (www.brtt.com). *dbloc2* is a program that generates hypocentral locations in latitude and longitude coordinates, depth, and origin time. We used an improved velocity model for the Wabash Valley region. Although there are different parameters which generate locations, we used the absolute P and S arrival times to generate locations. During this stage, we located 172 events which ranged from 10-21 km in depth. These single event locations contain large uncertainties due to the ambiguities of identifying first breaks. This ambiguity was most pronounced when analyzing emergent waveforms.

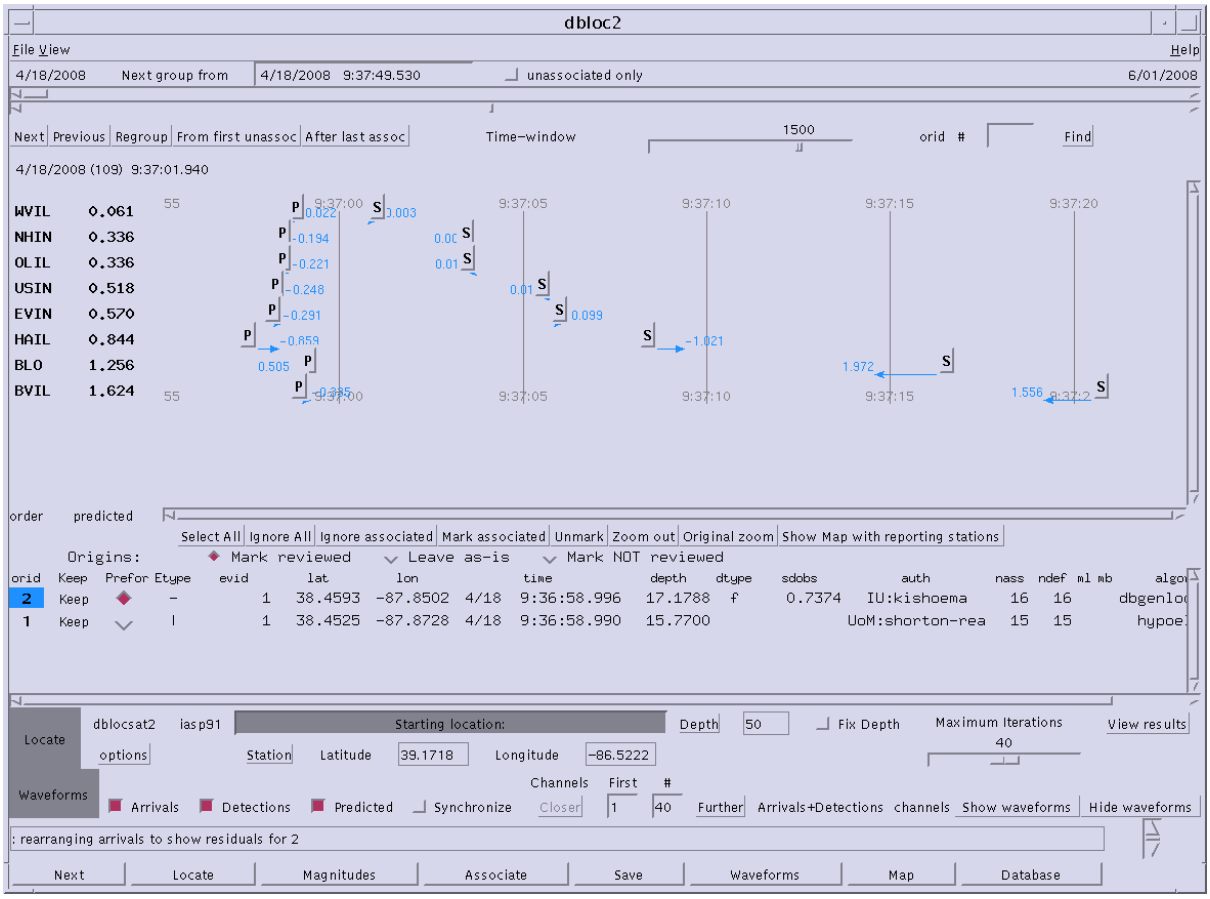

Figure 7: Screen shot of dbloc2. Locating the main shock.

We cross correlated the P arrivals in the third stage with *dbxcor* (Pavlis and Vernon, preprint). The principle of cross correlation is based on the hypothesis that multiple events generated along the same ruptured fault plane will exhibit similar waveforms. *dbxcor* uses a robust algorithm that penalizes waveforms which do not correlate with an average waveform computed by stacking a waveform ensemble(Pavlis and Vernon, preprint). This method removes human errors inherent in using picking procedures like *dbpick*. The precession of P arrival time picks is improved from the magnitude of tenths of seconds to milliseconds for impulsive event with high signal-to-noise ratio.

First, we assigned a grid system which divided the cluster into 9 cylinders stacked into 4 overlapping bases. Each grid cell had a minimum radius of 2 km and a range of 7.5 km. We established 10 as the minimum number of events per grid cell for the algorithm. If a grid cell did not contain at least ten events, the grid cell's radius was increased by 0.2 km until the cell achieved a maximum radius of 4 km. If the cell never contained 10 events, the cell was ignored and the event waveforms were not correlated. This reduced the number of grid cells analyzed from 36 to 10, but a few event locations were thrown out and not relocated. Twenty-two events were discarded during this stage. We assumed that some of these events deviated from the cluster because of the

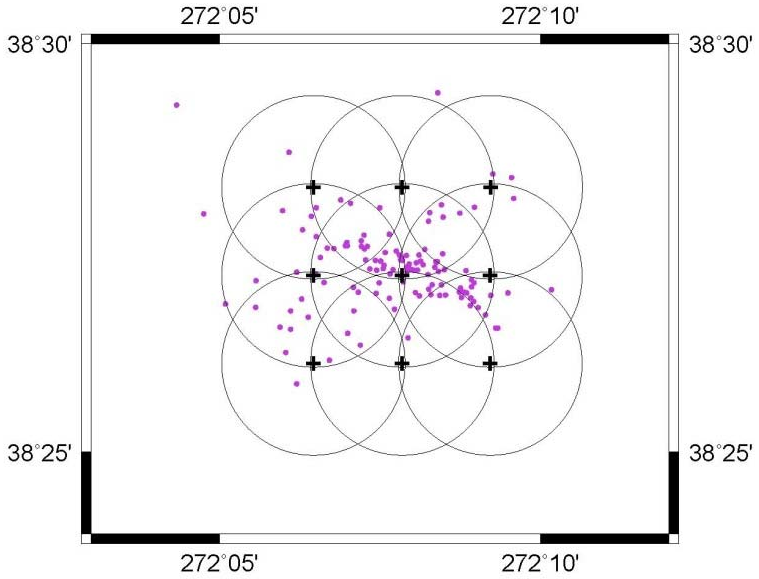

Figure 8: Map of minimum radius (2 km) of the grid cells. The grid cells are overlapping cylinders with height of 7.5 km. Each grid point contains 4 stacked cylinders.

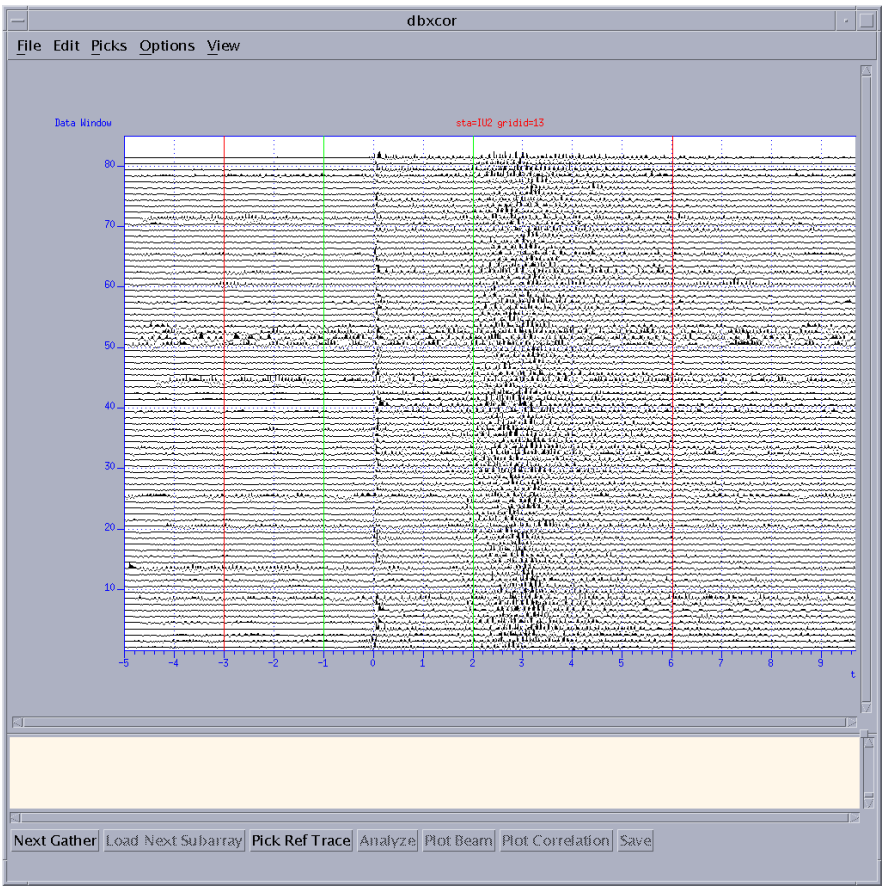

Figure 9: Raw data in dbxcor. Seismograms from station IU2 in grid 13.

imprecision of single event locations, although this assumption is worth noting and an area which must be re-examined in the future. After establishing parameters, the process of started by determining the period of correlation. First, the waveforms were filtered. The local stations required a 1 Hertz high-pass filter, while we selected a band-pass filter for the regional stations. The most distant stations required a narrow filter (2-5 Hertz band-pass) while we used 1-15 Hertz band-pass filters for the stations within 50 km from the cluster center. Next, we chose an analytical window which began 1-5 seconds before an event and ended about 0.5 second after the P arrival.

This window was determined by the type of waveform which depended directly upon the distance of the recording station from the event. A robust window was chosen which helped control the amplitude of the correlated waveforms after the algorithm had been run. The next step was selecting a reference waveform, one with a high signal-to-noise ratio and strong initial impulse. The data was processed through the robust algorithm used by *dbxcor* (Pavlis and Vernon, manuscript in preparation, 2009).

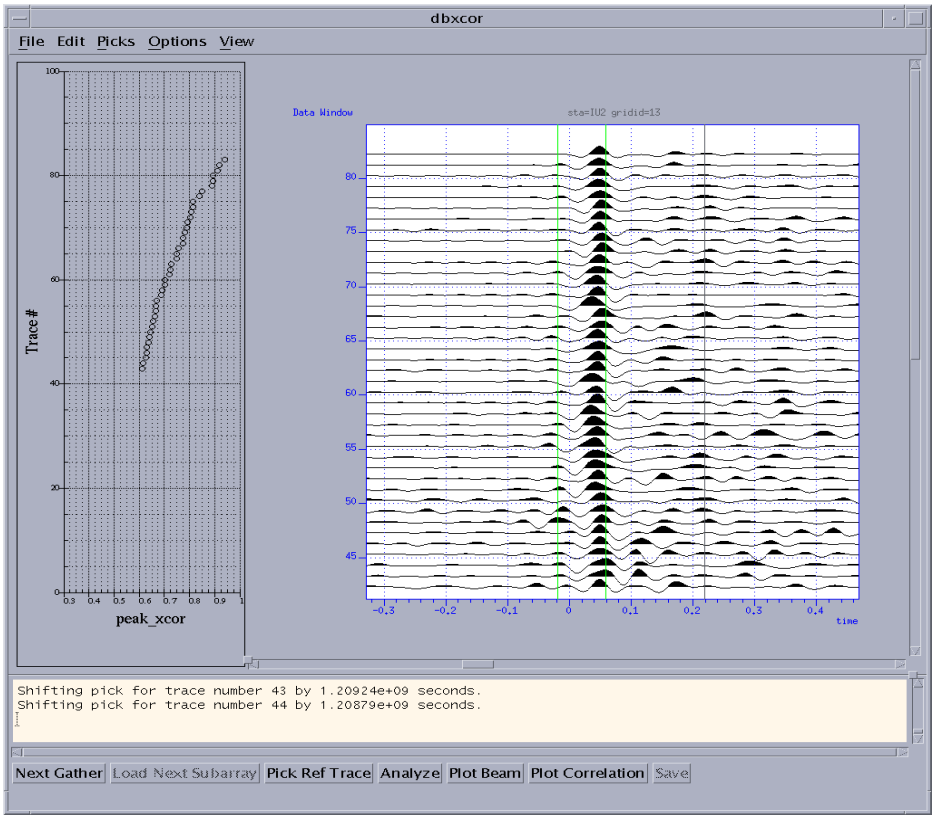

Figure 10: Screen shot of editing stack to produce aligned P arrival times using dbxcor. Graph of trace numbers as a function of peak cross correlation shown on the left. Seismograms from station IU2 in grid 13.

dbxcor generated cross correlation functions and we chose 0.60 as a waveform cutoff. The waveforms which had low signal-to-noise ratio or had a peak correlation below this cutoff value were not used to correct arrival time estimates. The next step was editing the waveforms. Some waveforms exhibited cycle skips while other waveforms had reversed polarities. This editing was done interactively with the *dbxcor* interface (Pavlis and Vernon, manuscript in preparation, 2009). After the waveforms were stacked, we plotted the P arrival on the reference waveform. The correlated waveforms were assigned corrected P arrival times. Originally, the refined *dbpick* P arrival was assigned the origin (t=0). This correlation process calculated the time difference between the new correlated P arrival and the arrival determined with *dbpick*.

The next stage was averaging the P arrival times for each event. Since the grid system overlapped and single events were correlated in multiple cells, there were some events with multiple P arrival times for the same waveforms. We used *xcoravg* (unpublished software) to average multiple P arrivals to a single arrival time per waveform for every event.

With correlated P arrivals, we relocated the events with *dbpmel* (http://antelopeusersgroup.org/cgi-bin/cvsweb.cgi/contrib/bin/location/dbpmel/). This program generated locations for events within each grid cell. Because of the grid overlap, we used a program *pmelavg* (http://antelopeusersgroup.org/cgi-bin/cvsweb.cgi/contrib/bin/location/pmelavg/) to generate a single location out of the multiple locations yielded for the same event associated with multiple grid cells. It accomplished this by averaging the locations. Out of the 419 locations generated by *dbpmel*, *pmelavg* reduced the number to 123 event locations. In addition, *pmelavg* produced space dependent station corrections for systematic errors caused by inadequacies of simplistic velocity models (Pavlis and Booker, 1983). Since the Earth is more complex than we are capable of modeling,

our locations will have inherent errors. Since we are locating a cluster of earthquakes, p*melavg* estimates station corrections using inverse methods based on the concept of joint hypocentral determination (Lay and Wallace, 1995).

Analysis Details

Emergent waveforms

While using *dbpick,* I noticed emergent waveforms on local stations. The most prominent waveforms appeared on the vertical channels of the seismograms from WVIL, but these waveforms were also present on the temporary arrays, especially on the three component stations. I noted the emergent waveform primarily on the vertical channel only with the P arrival.

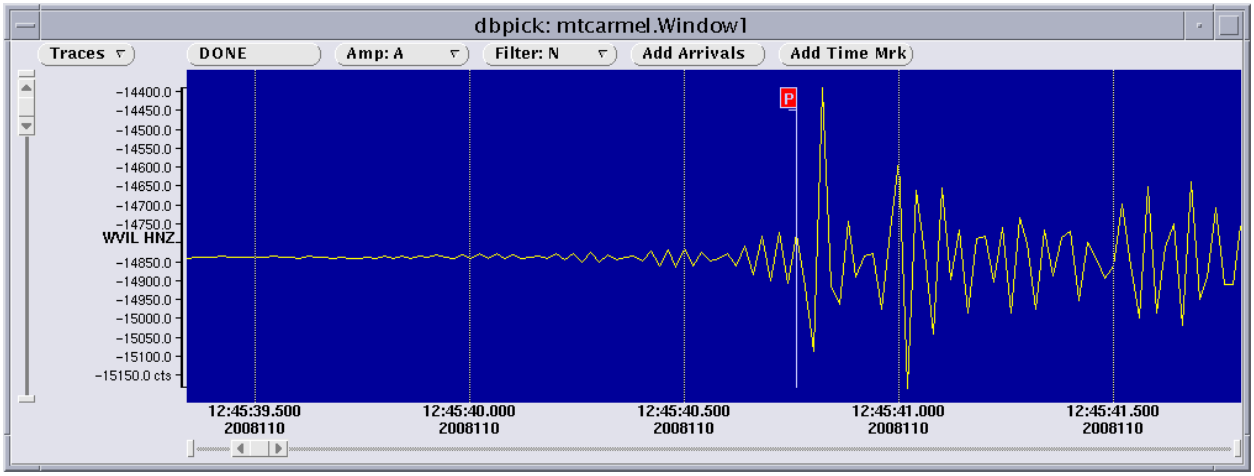

Figure 11: Screen Shot of dbpick with example of emergent waveform. Seismogram from station WVIL, recorded on April 19, 2008 at 12:45 GMT.

When I first noticed the presence of the emergent waveforms, I used a 1-5 Hz band-pass filter to remove them. Almost half of the local seismograms contained these waveforms, which presented a challenge when determining the P arrival. When I used *dbxcor* to correlate the P arrivals, the emergent waveforms could also be stacked and correlated up to 1 second prior to the designated P arrival time. I noted a pattern of the waveforms with the best signal-to-noise ratio, three wavelengths of increasing

amplitude followed by a lower frequency wave. This pattern repeated up to 1 second prior to the largest impulse which I designated as the P arrival. The presence of these waveforms prompted many questions.

1. What are emergent waveforms? Does their presence have any geologic significance? What causes the propagation of emergent waveforms?
2. How should analysts interpret these waveforms? How should their presence influence the analyst's selection of arrival times, if at all?

After searching through literature, I was unable to find the answers to these questions. I judge this as a phenomenon where further research is necessary.

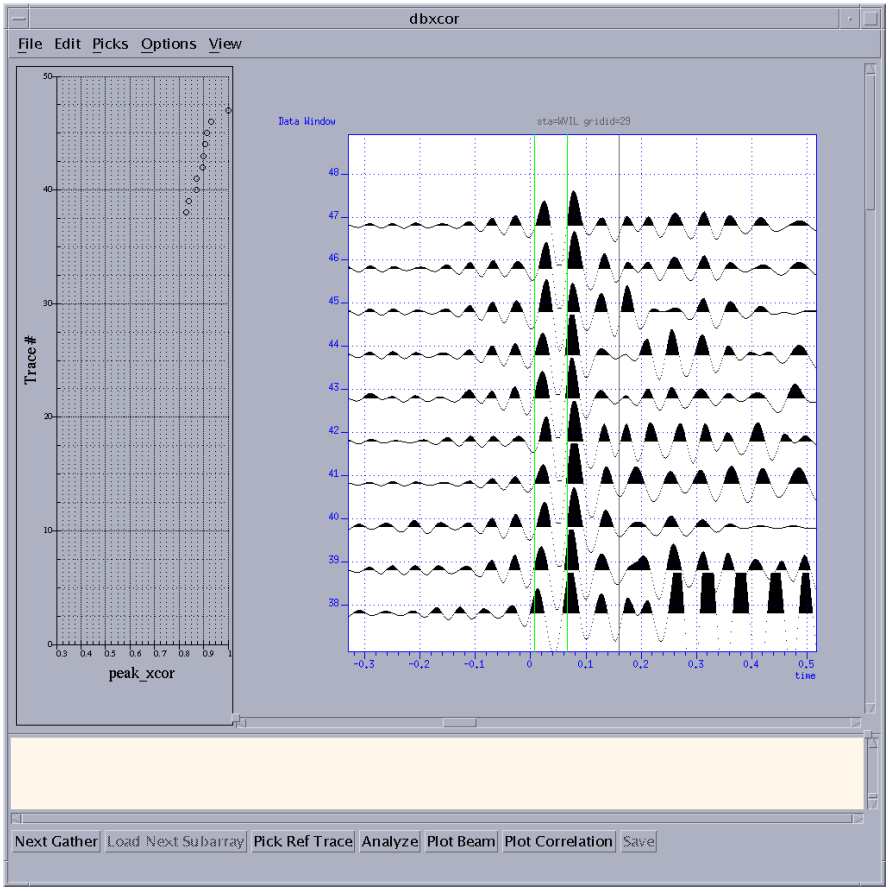

Figure 12: Snapshot of edited and stacked seismograms. Note the correlation of the emergent waveforms prior to the largest impulse. Seismograms from station WVIL in grid 29.

Results

Once the hypocenters were plotted on a map, we noted that they formed nearly west-north west trend. The depths ranged from 7-20 km and spanned an area 10 km long and 6 km wide. The hypocenters are aligned vertically on the cross section perpendicular to the trend of the locations. The lineament of

locations, which we interpreted as representing the ruptured fault plane, is consistent with focal mechanisms determined by Herrmann et al. (2008).

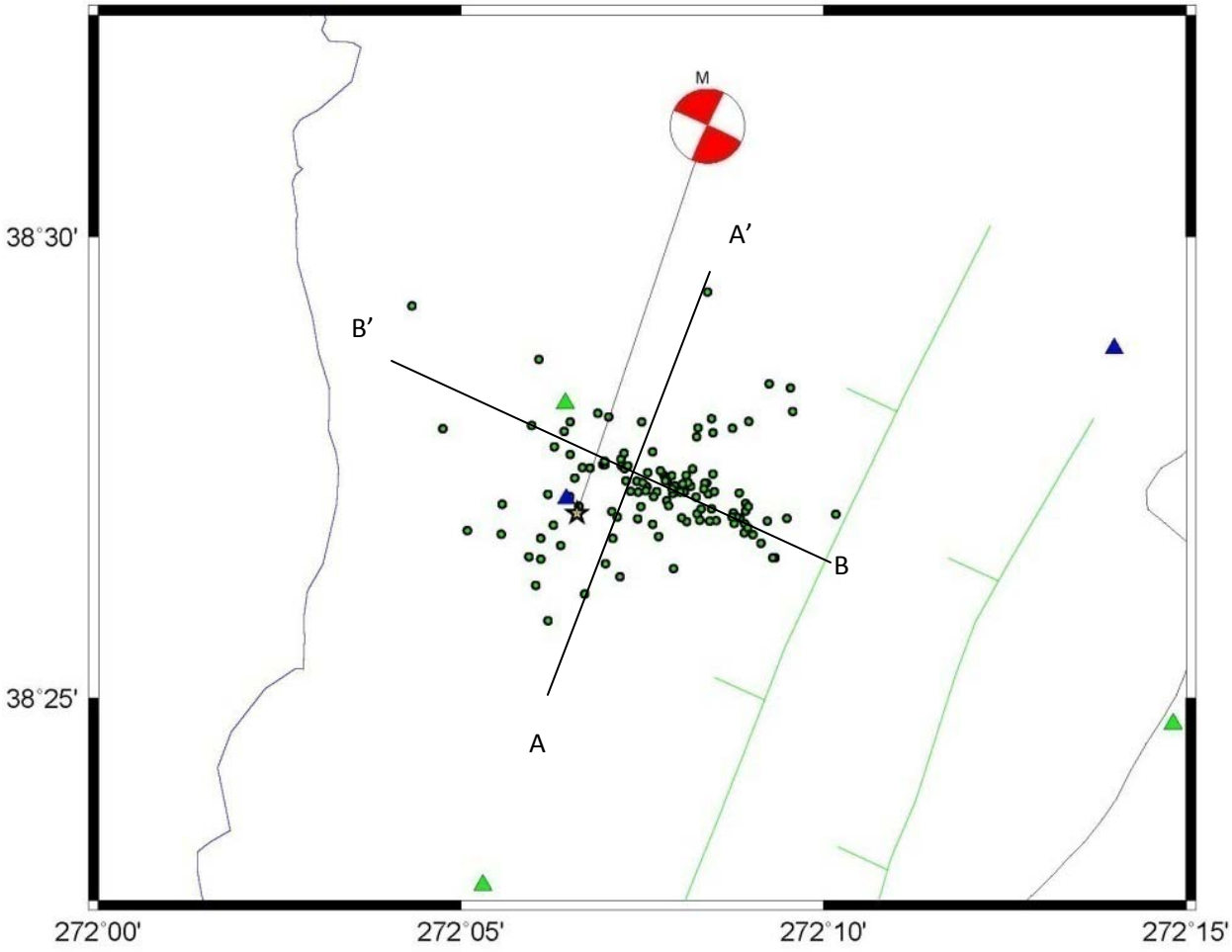

Figure 13: Map of event locations generated by pmelavg with seismic moment tensor for main shock (indicated with star). New Harmony fault is shown as green line with ticks. Location of cross sections indicated. Data provided by Global CMT (http://www.globalcmt)

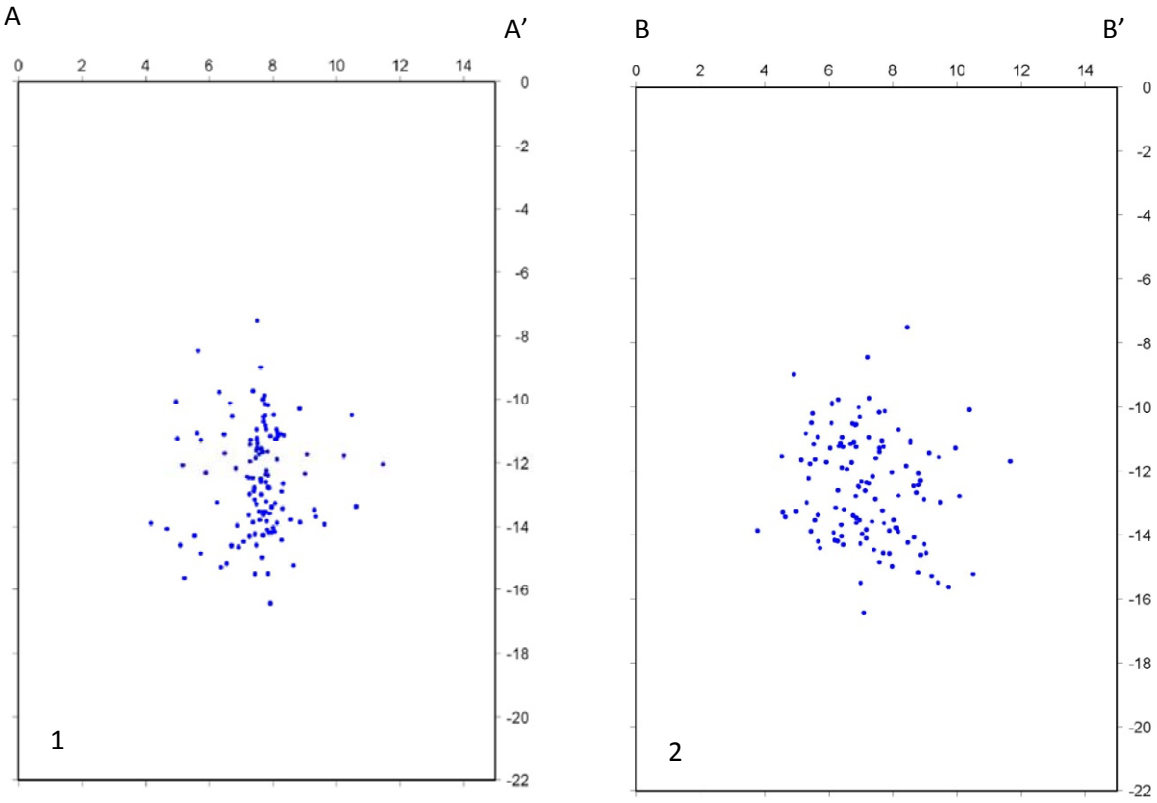

Figure 14: Cross sections of hypocenter locations generated by *pmelavg*. (1.) Perpendicular to the trend of the locations. Note the vertical plane formed. (2.) Parallel with the trend of the locations. Forms a localized cloud.

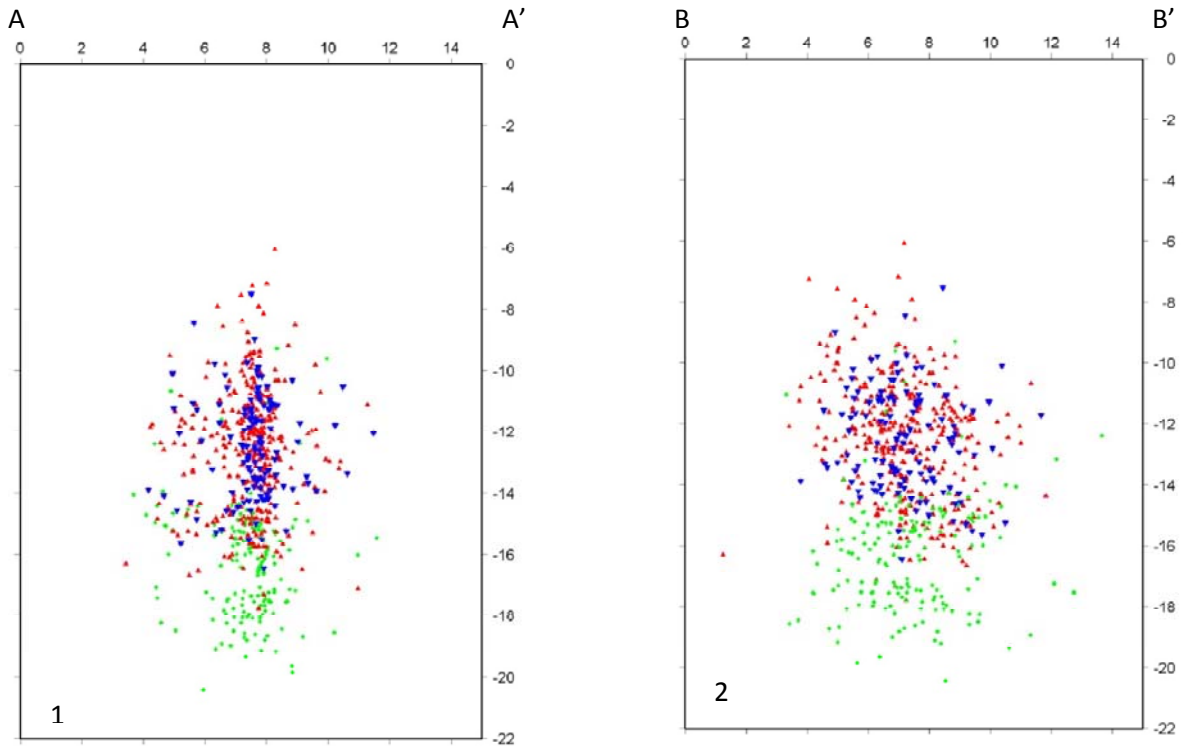

Figure 15: Cross sections of locations generated by each program. (1.) Perpendicular to the trend of the locations. Note the vertical plane formed. (2.) Parallel with the trend of the locations. Blue inverted triangles represent *pmelavg* locations; red triangles, *dbpmel* generated locations; green diamonds, *dbloc2* locations.

We plotted the locations generated from each program on a single cross section to compare the event locations through the process. It is clear that the single event locations generated by *dbloc2* form a cloud of locations, which collapse to form a vertical fault plane generated by *pmelavg*. When comparing the locations generated by each program, we noted a systematic shifting of the depths of the locations. The locations generated by *dbloc2* had a range of depths (~10 - 21 km) greater than the locations generated by either *dbpmel* (~6-16 km) or *pmelavg* (~7-16 km).

If the fault rupture occurred along the known fault traces of the WVFS, we expected the hypocenters to be located within a tight cluster with a north-northeast trend (Hildenbrand and Ravart, 1997) with depths of about 10-20 km based upon the depths of the four previous events in the region (McBride et al., 1997). However, the hypocentral locations we generated indicated that this

expectation is not correct, and the cluster strikes in orthogonal to the Mt. Carmel-New Harmony fault trace. This suggests that the event may not be directly related to the WVFS but rather another conjugate structure, perhaps related to the transition zone associated with the La Salle anticlinorium as has been suggested with the 1987 main shock and aftershock sequence (Hamburger and Rupp, 1988). Another possible interpretation is that the ruptured fault plane may be related to transfer faulting associated with fault termination of the WVFS. Transfer zones are the result of differential crustal movement, and the faults form to accommodate the differential movement and strain rates. Transfer faults are commonly seen in extensional provences as well as with the termination of faulting (Twiss and Moores, 1992).

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Appendix containing all aftershock locations available online.

Appendix

Event #	Longitude	Latitude	Depth (km)	Date	Day	Origin time (GMT)	Program
1	-87.8502	38.4593	17.1788	4/18/2008	-109	9:36:59	dbloc2
2	-87.8696	38.443	15.2528	4/18/2008	-109	10:04:00	dbloc2
3	-87.8928	38.4414	14.7711	4/18/2008	-109	10:06:07	dbloc2
4	-87.8207	38.4591	18.5276	4/18/2008	-109	10:15:31	dbloc2
4	-87.8204	38.4592	18.5562	4/18/2008	-109	10:15:31	dbloc2
5	-87.8487	38.4628	14.9028	4/18/2008	-109	10:15:39	dbloc2
6	-87.8566	38.461	19.6445	4/18/2008	-109	10:36:33	dbloc2
7	-87.9283	38.4956	12.3764	4/18/2008	-109	10:37:26	dbloc2
8	-87.8481	38.4481	16.1261	4/18/2008	-109	10:44:11	dbloc2
9	-87.8491	38.4579	19.8395	4/18/2008	-109	10:46:24	dbloc2
10	-87.892	38.4469	20.4199	4/18/2008	-109	10:57:47	dbloc2
11	-87.8734	38.4541	15.5238	4/18/2008	-109	11:25:26	dbloc2
12	-87.9047	38.4362	12.4027	4/18/2008	-109	11:55:58	dbloc2
13	-87.8937	38.4536	16.3418	4/18/2008	-109	15:14:17	dbloc2
14	-87.8766	38.4506	15.4553	4/18/2008	-109	23:14:33	dbloc2
15	-87.8531	38.4555	15.556	4/18/2008	-109	23:44:03	dbloc2
16	-87.8694	38.4431	11.5977	4/18/2008	-109	23:46:55	dbloc2
17	-87.854	38.4523	17.5003	4/19/2008	-110	2:19:52	dbloc2
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19	-87.8594	38.4634	14.8517	4/19/2008	-110	2:35:53	dbloc2
21	-87.8624	38.4555	14.6256	4/19/2008	-110	3:09:00	dbloc2
21	-87.8724	38.4597	13.0277	4/19/2008	-110	3:09:14	dbloc2
24	-87.8811	38.4586	18.0943	4/19/2008	-110	3:37:08	dbloc2
25	-87.88	38.4452	15.3608	4/19/2008	-110	3:48:06	dbloc2
26	-87.8555	38.4518	15.9331	4/19/2008	-110	3:50:15	dbloc2
27	-87.8575	38.448	14.8777	4/19/2008	-110	3:55:51	dbloc2
28	-87.9053	38.4403	15.0633	4/19/2008	-110	3:59:41	dbloc2

29	-87.8428	38.454	15.8534	4/19/2008	-110	4:27:41	dbloc2
30	-87.8477	38.4465	15.4352	4/19/2008	-110	6:41:20	dbloc2
31	-87.8536	38.4467	14.6503	4/19/2008	-110	6:50:43	dbloc2
32	-87.9097	38.4389	17.0694	4/19/2008	-110	7:30:10	dbloc2
33	-87.86	38.4464	15.2752	4/19/2008	-110	7:38:01	dbloc2
34	-87.8507	38.4441	15.805	4/19/2008	-110	7:49:44	dbloc2
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38	-87.9659	38.398	13.1406	4/19/2008	-110	10:59:07	dbloc2
39	-87.8586	38.4505	16.1206	4/19/2008	-110	12:00:35	dbloc2
40	-87.8475	38.4466	19.1481	4/19/2008	-110	12:41:33	dbloc2
41	-87.8958	38.4583	15.1028	4/19/2008	-110	12:45:38	dbloc2
42	-87.8709	38.4502	16.3994	4/19/2008	-110	12:46:43	dbloc2
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48	-87.8697	38.4536	15.1173	4/19/2008	-110	19:28:51	dbloc2
49	-87.86	38.4543	15.7465	4/19/2008	-110	19:57:45	dbloc2
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51	-87.8578	38.4557	17.2186	4/19/2008	-110	22:04:39	dbloc2
52	-87.856	38.4513	13.1986	4/19/2008	-110	23:31:23	dbloc2
53	-87.8701	38.4518	14.551	4/19/2008	-110	23:33:49	dbloc2
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55	-87.8404	38.4442	16.5898	4/20/2008	-111	2:17:27	dbloc2
56	-87.8711	38.4497	14.3494	4/20/2008	-111	3:19:27	dbloc2
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58	-87.9069	38.4442	18.4901	4/20/2008	-111	4:45:57	dbloc2
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62	-87.8778	38.46	14.9877	4/20/2008	-111	5:31:42	dbloc2
63	-87.8358	38.4499	17.5516	4/20/2008	-111	6:32:02	dbloc2
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67	-87.8825	38.4574	18.8037	4/20/2008	-111	10:34:26	dbloc2
68	-87.8933	38.4614	18.5747	4/20/2008	-111	15:51:11	dbloc2
69	-87.8846	38.4566	17.6425	4/20/2008	-111	18:16:45	dbloc2
70	-87.8723	38.4545	14.6846	4/20/2008	-111	18:27:50	dbloc2
71	-87.9111	38.4418	13.9392	4/20/2008	-111	20:05:55	dbloc2
72	-87.8454	38.4472	17.4451	4/20/2008	-111	20:37:45	dbloc2
73	-87.881	38.4489	17.8241	4/20/2008	-111	20:54:04	dbloc2
74	-87.8745	38.4564	15.2297	4/20/2008	-111	21:38:42	dbloc2
75	-87.8582	38.4559	17.1367	4/20/2008	-111	22:30:41	dbloc2
76	-87.8647	38.4547	17.9641	4/20/2008	-111	23:05:12	dbloc2
77	-87.9053	38.4627	15.7176	4/21/2008	-112	0:37:50	dbloc2
78	-87.8584	38.4903	15.4379	4/21/2008	-112	0:45:19	dbloc2
79	-87.9062	38.4675	19.3556	4/21/2008	-112	2:10:04	dbloc2
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81	-87.8627	38.4544	16.5916	4/21/2008	-112	4:11:20	dbloc2
82	-87.8814	38.456	14.7833	4/21/2008	-112	4:13:26	dbloc2
83	-87.8865	38.4487	19.0913	4/21/2008	-112	4:33:35	dbloc2
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86	-87.8702	38.4465	18.9829	4/21/2008	-112	8:37:16	dbloc2
87	-87.8826	38.4534	17.2818	4/21/2008	-112	8:56:41	dbloc2

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93	-87.8926	38.4504	18.1461	4/21/2008	-112	17:39:33	dbloc2
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95	-87.8915	38.4565	16.1916	4/21/2008	-112	19:08:24	dbloc2
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99	-87.9059	38.4414	15.9913	4/22/2008	-113	7:33:48	dbloc2
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101	-87.866	38.4591	16.0448	4/22/2008	-113	7:43:39	dbloc2
102	-87.8563	38.4726	9.6026	4/22/2008	-113	8:01:01	dbloc2
103	-87.8847	38.4574	17.881	4/22/2008	-113	8:32:25	dbloc2
104	-87.8853	38.4571	18.0764	4/22/2008	-113	8:38:53	dbloc2
105	-87.8615	38.4492	15.9296	4/22/2008	-113	10:46:23	dbloc2
106	-87.8509	38.4486	16.2146	4/22/2008	-113	13:48:19	dbloc2
107	-87.8595	38.4486	11.279	4/23/2008	-114	1:32:35	dbloc2
108	-87.8552	38.4826	16.0024	4/23/2008	-114	5:52:54	dbloc2
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111	-87.8893	38.4494	15.0245	4/23/2008	-114	19:27:31	dbloc2
112	-87.8725	38.4478	14.3911	4/23/2008	-114	21:22:18	dbloc2
113	-87.8756	38.4566	15.6633	4/24/2008	-115	5:56:43	dbloc2
114	-87.8699	38.4575	17.5235	4/24/2008	-115	10:23:52	dbloc2
115	-87.8791	38.4657	19.1818	4/24/2008	-115	11:44:24	dbloc2
116	-87.8851	38.4555	14.8687	4/24/2008	-115	15:38:58	dbloc2

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120	-87.8734	38.4491	15.4705	4/25/2008	-116	5:08:48	dbloc2
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126	-87.8994	38.4581	18.2472	4/25/2008	-116	18:52:54	dbloc2
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130	-87.8671	38.4566	18.7959	4/26/2008	-117	12:35:32	dbloc2
131	-87.919	38.4397	14.7146	4/26/2008	-117	13:23:12	dbloc2
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132	-87.8887	38.4531	17.9368	4/26/2008	-117	15:00:50	dbloc2
132	-87.8887	38.4531	17.9353	4/26/2008	-117	15:00:50	dbloc2
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136	-87.8673	38.4495	15.5638	4/27/2008	-118	4:52:31	dbloc2
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138	-87.8719	38.4583	15.5229	4/27/2008	-118	8:26:58	dbloc2
139	-87.9007	38.4407	14.6622	4/27/2008	-118	8:57:28	dbloc2
140	-87.8642	38.4529	16.6426	4/27/2008	-118	11:25:02	dbloc2
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141	-87.8527	38.453	17.9167	4/27/2008	-118	12:05:17	dbloc2
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147	-87.8534	38.4485	15.2034	4/28/2008	-119	7:35:45	dbloc2
147	-87.8534	38.4479	15.304	4/28/2008	-119	7:35:45	dbloc2
148	-87.8693	38.4496	18.2403	4/28/2008	-119	9:20:56	dbloc2
149	-87.8533	38.4498	15.1997	4/28/2008	-119	21:46:59	dbloc2
149	-87.8529	38.4495	15.1841	4/28/2008	-119	21:46:59	dbloc2
150	-87.917	38.4642	18.9123	4/29/2008	-120	5:24:56	dbloc2
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151	-87.8613	38.4527	16.4391	4/30/2008	-121	4:24:48	dbloc2
152	-87.8787	38.4512	18.0692	4/30/2008	-121	17:27:37	dbloc2
152	-87.879	38.4516	18.0736	4/30/2008	-121	17:27:37	dbloc2
153	-87.866	38.458	17.5454	4/30/2008	-121	19:29:19	dbloc2
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154	-87.868	38.4486	15.2248	4/30/2008	-121	20:25:28	dbloc2
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161	-87.8464	38.4557	17.1334	5/3/2008	-124	0:34:19	dbloc2
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166	-87.8748	38.4582	16.4745	5/5/2008	-126	14:56:09	dbloc2
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168	-87.8708	38.4567	17.1244	5/6/2008	-127	7:55:07	dbloc2
169	-87.8714	38.4562	17.3342	5/6/2008	-127	7:57:03	dbloc2
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173	-87.8773	38.4515	15.4732	5/16/2008	-137	3:46:11	dbloc2
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187	-87.899	38.4613	15.9889	4/19/2008	-110	13:17:26	dbloc2
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13	-87.8987	38.4778	15.2133	4/18/2008	-109	15:14:17	dbpmel
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15	-87.8527	38.4537	14.4034	4/18/2008	-109	23:44:04	dbpmel
15	-87.8566	38.4449	11.1902	4/18/2008	-109	23:44:04	dbpmel
16	-87.8625	38.4469	8.3681	4/18/2008	-109	23:46:56	dbpmel
16	-87.8694	38.4379	10.201	4/18/2008	-109	23:46:56	dbpmel
16	-87.88	38.4381	13.2519	4/18/2008	-109	23:46:55	dbpmel
17	-87.8717	38.4435	10.966	4/19/2008	-110	2:19:53	dbpmel
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18	-87.8598	38.4535	14.1762	4/19/2008	-110	2:33:01	dbpmel
19	-87.8472	38.4665	10.6816	4/19/2008	-110	2:35:54	dbpmel
19	-87.8421	38.48	11.101	4/19/2008	-110	2:35:54	dbpmel
19	-87.8499	38.466	9.8074	4/19/2008	-110	2:35:54	dbpmel
19	-87.8493	38.4662	12.4736	4/19/2008	-110	2:35:53	dbpmel
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20	-87.8913	38.4454	12.3534	4/19/2008	-110	3:05:54	dbpmel
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21	-87.8787	38.4459	7.892	4/19/2008	-110	3:09:15	dbpmel
21	-87.8954	38.4479	12.2857	4/19/2008	-110	3:09:14	dbpmel
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21	-87.8666	38.4571	7.1601	4/19/2008	-110	3:09:15	dbpmel
24	-87.8837	38.4583	15.3552	4/19/2008	-110	3:37:09	dbpmel
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24	-87.8891	38.4608	14.8154	4/19/2008	-110	3:37:09	dbpmel
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25	-87.8824	38.4434	11.5666	4/19/2008	-110	3:48:06	dbpmel
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25	-87.8783	38.4484	9.7791	4/19/2008	-110	3:48:07	dbpmel
26	-87.8591	38.4528	11.8519	4/19/2008	-110	3:50:15	dbpmel
26	-87.8604	38.4554	10.9402	4/19/2008	-110	3:50:16	dbpmel
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28	-87.8983	38.4417	12.0644	4/19/2008	-110	3:59:41	dbpmel
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29	-87.8631	38.4617	12.5347	4/19/2008	-110	4:27:42	dbpmel
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31	-87.8568	38.4492	10.8126	4/19/2008	-110	6:50:44	dbpmel
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37	-87.8628	38.4515	13.6843	4/19/2008	-110	10:06:59	dbpmel
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39	-87.859	38.451	12.0355	4/19/2008	-110	12:00:36	dbpmel
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41	-87.9007	38.4551	12.6154	4/19/2008	-110	12:45:38	dbpmel
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52	-87.8649	38.4569	11.2317	4/19/2008	-110	23:31:24	dbpmel
52	-87.8655	38.4551	12.0947	4/19/2008	-110	23:31:24	dbpmel
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53	-87.8676	38.4542	9.9912	4/19/2008	-110	23:33:50	dbpmel
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54	-87.8572	38.4505	10.8079	4/20/2008	-111	1:19:30	dbpmel
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55	-87.8409	38.4392	10.4657	4/20/2008	-111	2:17:28	dbpmel
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59	-87.8418	38.4491	13.4145	4/20/2008	-111	5:02:42	dbpmel
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60	-87.8989	38.4424	10.8131	4/20/2008	-111	5:09:43	dbpmel
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62	-87.8823	38.4599	12.3603	4/20/2008	-111	5:31:43	dbpmel
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66	-87.8635	38.4594	12.7791	4/20/2008	-111	9:59:45	dbpmel
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69	-87.891	38.4541	12.5121	4/20/2008	-111	18:16:46	dbpmel
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69	-87.8983	38.4481	16.5014	4/20/2008	-111	18:16:45	dbpmel
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72	-87.8438	38.4403	11.2448	4/20/2008	-111	20:37:46	dbpmel
73	-87.8968	38.444	15.2297	4/20/2008	-111	20:54:04	dbpmel
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74	-87.8836	38.4681	13.6171	4/20/2008	-111	21:38:42	dbpmel
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75	-87.8633	38.4573	11.9628	4/20/2008	-111	22:30:42	dbpmel
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75	-87.8621	38.4675	13.7184	4/20/2008	-111	22:30:42	dbpmel
75	-87.865	38.4577	14.3463	4/20/2008	-111	22:30:42	dbpmel

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82	-87.8805	38.4603	11.629	4/21/2008	-112	4:13:27	dbpmel
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85	-87.8883	38.4556	14.2682	4/21/2008	-112	7:58:46	dbpmel
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87	-87.8751	38.4665	13.7683	4/21/2008	-112	8:56:41	dbpmel
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88	-87.8957	38.4553	15.1936	4/21/2008	-112	8:59:39	dbpmel
88	-87.8799	38.4588	13.4475	4/21/2008	-112	8:59:40	dbpmel
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93	-87.8762	38.449	14.691	4/21/2008	-112	17:39:34	dbpmel
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95	-87.8944	38.4614	11.6271	4/21/2008	-112	19:08:25	dbpmel
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103	-87.8815	38.4593	15.7576	4/22/2008	-113	8:32:26	dbpmel
103	-87.8837	38.4606	14.8193	4/22/2008	-113	8:32:26	dbpmel
103	-87.9008	38.4552	14.8007	4/22/2008	-113	8:32:26	dbpmel
103	-87.8791	38.4581	13.5075	4/22/2008	-113	8:32:26	dbpmel
104	-87.8917	38.453	15.1593	4/22/2008	-113	8:38:53	dbpmel
104	-87.8841	38.4598	14.7886	4/22/2008	-113	8:38:53	dbpmel
104	-87.8792	38.4562	12.7968	4/22/2008	-113	8:38:54	dbpmel
105	-87.8636	38.448	14.7799	4/22/2008	-113	10:46:23	dbpmel
105	-87.8603	38.4474	12.437	4/22/2008	-113	10:46:23	dbpmel
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106	-87.8513	38.4518	11.1495	4/22/2008	-113	13:48:20	dbpmel
106	-87.8484	38.4484	13.0333	4/22/2008	-113	13:48:20	dbpmel
106	-87.8441	38.4403	10.3458	4/22/2008	-113	13:48:20	dbpmel
107	-87.8678	38.4575	14.9022	4/23/2008	-114	1:32:34	dbpmel
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107	-87.8703	38.4566	13.7816	4/23/2008	-114	1:32:34	dbpmel
107	-87.8682	38.4573	13.2216	4/23/2008	-114	1:32:34	dbpmel
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108	-87.8623	38.4799	12.9554	4/23/2008	-114	5:52:54	dbpmel
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111	-87.8789	38.4477	8.5617	4/23/2008	-114	19:27:32	dbpmel
111	-87.8802	38.4483	11.3284	4/23/2008	-114	19:27:32	dbpmel

112	-87.8695	38.449	11.3532	4/23/2008	-114	21:22:19	dbpmel
112	-87.8739	38.4528	11.1663	4/23/2008	-114	21:22:19	dbpmel
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113	-87.8708	38.4577	13.5683	4/24/2008	-115	5:56:43	dbpmel
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113	-87.8697	38.4595	11.0115	4/24/2008	-115	5:56:44	dbpmel
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116	-87.8901	38.4616	11.3353	4/24/2008	-115	15:38:59	dbpmel
116	-87.8858	38.4579	10.1537	4/24/2008	-115	15:38:59	dbpmel
117	-87.8957	38.4391	11.33	4/24/2008	-115	22:08:10	dbpmel
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122	-87.8671	38.449	14.1261	4/25/2008	-116	10:15:49	dbpmel
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124	-87.8731	38.4532	14.2095	4/25/2008	-116	17:31:01	dbpmel
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126	-87.9104	38.453	14.5991	4/25/2008	-116	18:52:54	dbpmel
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128	-87.8404	38.4684	11.7679	4/26/2008	-117	1:06:52	dbpmel
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129	-87.8513	38.4532	13.5084	4/26/2008	-117	4:45:37	dbpmel
129	-87.8422	38.4418	12.1206	4/26/2008	-117	4:45:37	dbpmel
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132	-87.8847	38.4503	14.7472	4/26/2008	-117	15:00:51	dbpmel
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132	-87.8762	38.4558	14.5617	4/26/2008	-117	15:00:51	dbpmel
133	-87.8718	38.4569	12.5951	4/26/2008	-117	20:14:46	dbpmel
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134	-87.8717	38.4499	12.7507	4/27/2008	-118	1:34:21	dbpmel
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135	-87.8481	38.4487	14.5862	4/27/2008	-118	2:33:14	dbpmel
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136	-87.8642	38.4508	11.9937	4/27/2008	-118	4:52:32	dbpmel
136	-87.865	38.4548	10.1248	4/27/2008	-118	4:52:32	dbpmel

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137	-87.8694	38.4523	15.4951	4/27/2008	-118	8:08:23	dbpmel
138	-87.8829	38.4672	11.5342	4/27/2008	-118	8:26:59	dbpmel
138	-87.8909	38.4701	13.447	4/27/2008	-118	8:26:58	dbpmel
138	-87.8868	38.4687	13.8059	4/27/2008	-118	8:26:58	dbpmel
139	-87.8882	38.4354	11.2238	4/27/2008	-118	8:57:29	dbpmel
139	-87.8983	38.4425	11.5991	4/27/2008	-118	8:57:29	dbpmel
140	-87.8633	38.4512	12.7675	4/27/2008	-118	11:25:03	dbpmel
140	-87.8638	38.451	11.2022	4/27/2008	-118	11:25:03	dbpmel
141	-87.855	38.4529	12.3623	4/27/2008	-118	12:05:18	dbpmel
141	-87.8539	38.4482	13.5194	4/27/2008	-118	12:05:18	dbpmel
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143	-87.8742	38.4541	12.8782	4/27/2008	-118	16:49:13	dbpmel
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144	-87.8692	38.4505	13.6963	4/27/2008	-118	23:01:22	dbpmel
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145	-87.8987	38.4462	11.8814	4/28/2008	-119	6:39:27	dbpmel
146	-87.9089	38.462	11.6683	4/28/2008	-119	6:55:56	dbpmel
146	-87.8929	38.4648	11.5615	4/28/2008	-119	6:55:56	dbpmel
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148	-87.8622	38.4531	13.2988	4/28/2008	-119	9:20:57	dbpmel
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149	-87.85	38.4426	9.5378	4/28/2008	-119	21:47:00	dbpmel
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152	-87.8719	38.4596	14.7999	4/30/2008	-121	17:27:37	dbpmel
152	-87.871	38.4591	12.8567	4/30/2008	-121	17:27:37	dbpmel
153	-87.8816	38.4518	15.4088	4/30/2008	-121	19:29:19	dbpmel
153	-87.8731	38.4564	15.3532	4/30/2008	-121	19:29:19	dbpmel
153	-87.8866	38.4602	15.6478	4/30/2008	-121	19:29:19	dbpmel
154	-87.8671	38.4502	11.517	4/30/2008	-121	20:25:29	dbpmel
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155	-87.8555	38.4513	12.0631	5/1/2008	-122	0:53:35	dbpmel
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157	-87.8312	38.4403	12.0825	5/1/2008	-122	6:22:26	dbpmel
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159	-87.8731	38.4607	11.4755	5/2/2008	-123	4:13:32	dbpmel
159	-87.8715	38.4621	9.9615	5/2/2008	-123	4:13:32	dbpmel
159	-87.8722	38.4598	10.8446	5/2/2008	-123	4:13:32	dbpmel
160	-87.8615	38.4558	12.1741	5/2/2008	-123	11:39:19	dbpmel
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163	-87.8625	38.4638	10.2939	5/3/2008	-124	14:21:55	dbpmel
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164	-87.905	38.443	12.3793	5/3/2008	-124	14:42:43	dbpmel
164	-87.903	38.4375	12.3702	5/3/2008	-124	14:42:43	dbpmel
165	-87.9072	38.4516	11.2726	5/5/2008	-126	8:17:05	dbpmel
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166	-87.8741	38.4557	11.1224	5/5/2008	-126	14:56:10	dbpmel
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167	-87.8644	38.4542	12.1725	5/5/2008	-126	17:56:57	dbpmel
167	-87.8665	38.4535	10.7966	5/5/2008	-126	17:56:57	dbpmel
167	-87.8659	38.4543	10.0293	5/5/2008	-126	17:56:57	dbpmel
168	-87.8693	38.4564	12.2387	5/6/2008	-127	7:55:08	dbpmel
168	-87.8692	38.4553	14.5131	5/6/2008	-127	7:55:07	dbpmel
168	-87.8699	38.4569	13.8856	5/6/2008	-127	7:55:07	dbpmel
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169	-87.8706	38.4555	14.7993	5/6/2008	-127	7:57:03	dbpmel
170	-87.8675	38.455	13.5135	5/6/2008	-127	13:21:55	dbpmel
170	-87.8668	38.4555	16.041	5/6/2008	-127	13:21:55	dbpmel
170	-87.8675	38.4729	15.2746	5/6/2008	-127	13:21:55	dbpmel
171	-87.8794	38.4608	11.8831	5/9/2008	-130	14:43:43	dbpmel
171	-87.8737	38.4574	10.1462	5/9/2008	-130	14:43:43	dbpmel
172	-87.8681	38.4544	14.2497	5/10/2008	-131	11:57:40	dbpmel
172	-87.8673	38.4572	15.753	5/10/2008	-131	11:57:40	dbpmel
172	-87.8663	38.4557	13.5245	5/10/2008	-131	11:57:40	dbpmel
173	-87.8721	38.4546	12.0445	5/16/2008	-137	3:46:11	dbpmel
173	-87.8736	38.4561	10.3899	5/16/2008	-137	3:46:11	dbpmel

173	-87.8747	38.4569	11.9689	5/16/2008	-137	3:46:11	dbpmel
174	-87.8765	38.4624	13.4428	5/19/2008	-140	4:07:25	dbpmel
174	-87.8886	38.4565	12.5881	5/19/2008	-140	4:07:25	dbpmel
174	-87.8792	38.4609	12.7592	5/19/2008	-140	4:07:25	dbpmel
174	-87.8767	38.4594	10.6943	5/19/2008	-140	4:07:25	dbpmel
175	-87.852	38.4716	12.9529	6/1/2008	-153	14:56:13	dbpmel
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183	-87.8453	38.4429	9.4161	4/19/2008	-110	9:46:44	dbpmel
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183	-87.8505	38.4412	7.544	4/19/2008	-110	9:46:44	dbpmel
183	-87.8535	38.4485	7.9018	4/19/2008	-110	9:46:45	dbpmel
187	-87.9004	38.4659	12.7715	4/19/2008	-110	13:17:26	dbpmel
187	-87.9147	38.4614	12.6022	4/19/2008	-110	13:17:26	dbpmel
1	-87.8728	38.4525	15.77	4/18/2008	-109	9:36:59	CERI location
2	-87.8677	38.4502	13.86	4/18/2008	-109	10:04:00	CERI location
3	-87.8925	38.4417	14.75	4/18/2008	-109	10:06:07	CERI location
4	-87.8408	38.4552	16.21	4/18/2008	-109	10:15:31	CERI location
6	-87.8722	38.4495	15.67	4/18/2008	-109	10:36:33	CERI location
7	-87.8555	38.4808	14.22	4/18/2008	-109	10:37:26	CERI location
8	-87.8497	38.4502	15.45	4/18/2008	-109	10:44:11	CERI location
9	-87.8757	38.444	18.02	4/18/2008	-109	10:46:24	CERI location
10	-87.9093	38.4428	17.01	4/18/2008	-109	10:57:48	CERI location
11	-87.8765	38.454	15.06	4/18/2008	-109	11:25:26	CERI location
12	-87.9033	38.4368	12.3	4/18/2008	-109	11:55:58	CERI location
13	-87.8937	38.4535	16.34	4/18/2008	-109	15:14:17	CERI location
14	-87.8632	38.452	12.26	4/18/2008	-109	23:14:33	CERI location
15	-87.856	38.4497	14.79	4/18/2008	-109	23:44:04	CERI location
16	-87.8662	38.4458	9.83	4/18/2008	-109	23:46:56	CERI location
17	-87.8517	38.4472	16.41	4/19/2008	-110	2:19:52	CERI location

18	-87.861	38.453	16.92	4/19/2008	-110	2:33:00	CERI location
19	-87.8757	38.4573	15.14	4/19/2008	-110	2:35:53	CERI location
20	-87.8758	38.4493	8.26	4/19/2008	-110	3:05:54	CERI location
21	-87.8647	38.4505	15.29	4/19/2008	-110	3:08:59	CERI location
24	-87.8793	38.458	16.97	4/19/2008	-110	3:37:09	CERI location
25	-87.877	38.4493	13.9	4/19/2008	-110	3:48:06	CERI location
26	-87.8672	38.4492	15.79	4/19/2008	-110	3:50:15	CERI location
27	-87.8575	38.448	14.88	4/19/2008	-110	3:55:51	CERI location
28	-87.8858	38.4427	12.25	4/19/2008	-110	3:59:41	CERI location
29	-87.8518	38.4478	13.37	4/19/2008	-110	4:27:42	CERI location
30	-87.8432	38.447	14.37	4/19/2008	-110	6:41:21	CERI location
31	-87.8603	38.447	13.46	4/19/2008	-110	6:50:44	CERI location
32	-87.8925	38.4383	15.69	4/19/2008	-110	7:30:10	CERI location
33	-87.8195	38.4375	14.74	4/19/2008	-110	7:38:01	CERI location
34	-87.8252	38.4367	14.46	4/19/2008	-110	7:49:45	CERI location
35	-87.8678	38.4445	13.22	4/19/2008	-110	8:25:08	CERI location
37	-87.8487	38.4497	16.28	4/19/2008	-110	10:06:58	CERI location
38	-87.8517	38.4468	9.62	4/19/2008	-110	10:59:08	CERI location
39	-87.8612	38.4495	15.6	4/19/2008	-110	12:00:35	CERI location
40	-87.8282	38.4565	17.26	4/19/2008	-110	12:41:34	CERI location
41	-87.8808	38.4388	10.79	4/19/2008	-110	12:45:38	CERI location
42	-87.8547	38.449	14.83	4/19/2008	-110	12:46:44	CERI location
43	-87.8497	38.4545	12.75	4/19/2008	-110	13:08:57	CERI location
45	-87.92	38.44	13.55	4/19/2008	-110	14:01:02	CERI location
46	-87.882	38.4308	10.53	4/19/2008	-110	16:55:18	CERI location
47	-87.868	38.4467	16.01	4/19/2008	-110	19:03:36	CERI location
48	-87.862	38.4525	12.3	4/19/2008	-110	19:28:52	CERI location
49	-87.86	38.4548	15.31	4/19/2008	-110	19:57:45	CERI location
50	-87.8492	38.454	13.52	4/19/2008	-110	21:03:10	CERI location

51	-87.8578	38.4543	16.29	4/19/2008	-110	22:04:39	CERI location
52	-87.856	38.4512	13.19	4/19/2008	-110	23:31:23	CERI location
53	-87.8705	38.4512	14.19	4/19/2008	-110	23:33:49	CERI location
54	-87.8432	38.4445	14.69	4/20/2008	-111	1:19:29	CERI location
55	-87.8385	38.4473	14.07	4/20/2008	-111	2:17:27	CERI location
56	-87.8602	38.4508	11.19	4/20/2008	-111	3:19:27	CERI location
57	-87.8567	38.4493	13.02	4/20/2008	-111	4:35:28	CERI location
58	-87.899	38.4457	16.73	4/20/2008	-111	4:45:57	CERI location
59	-87.8312	38.4518	9.74	4/20/2008	-111	5:02:43	CERI location
60	-87.8803	38.4427	11.88	4/20/2008	-111	5:09:43	CERI location
61	-87.8673	38.4555	14.19	4/20/2008	-111	5:21:50	CERI location
62	-87.8685	38.4582	10.36	4/20/2008	-111	5:31:43	CERI location
63	-87.8255	38.4523	10.99	4/20/2008	-111	6:32:03	CERI location
64	-87.8517	38.4477	16.68	4/20/2008	-111	7:42:33	CERI location
65	-87.8493	38.4357	15.76	4/20/2008	-111	8:51:56	CERI location
66	-87.8452	38.4453	8.45	4/20/2008	-111	9:59:45	CERI location
67	-87.8783	38.4732	13.56	4/20/2008	-111	10:34:27	CERI location
68	-87.8875	38.4525	11.9	4/20/2008	-111	15:51:12	CERI location
69	-87.8857	38.4493	16.96	4/20/2008	-111	18:16:45	CERI location
70	-87.8632	38.4585	12.04	4/20/2008	-111	18:27:50	CERI location
71	-87.9037	38.4588	13.05	4/20/2008	-111	20:05:55	CERI location
72	-87.8403	38.4345	16.99	4/20/2008	-111	20:37:45	CERI location
73	-87.8687	38.4473	15.93	4/20/2008	-111	20:54:04	CERI location
74	-87.8758	38.4573	14.89	4/20/2008	-111	21:38:42	CERI location
75	-87.8532	38.4518	15.71	4/20/2008	-111	22:30:41	CERI location
76	-87.8527	38.4497	16.05	4/20/2008	-111	23:05:12	CERI location
77	-87.908	38.4595	15.5	4/21/2008	-112	0:37:50	CERI location
78	-87.8595	38.4867	14.53	4/21/2008	-112	0:45:19	CERI location
79	-87.8917	38.4498	18.88	4/21/2008	-112	2:10:04	CERI location

80	-87.8587	38.4572	14.16	4/21/2008	-112	4:05:55	CERI location
81	-87.8588	38.4497	14.24	4/21/2008	-112	4:11:21	CERI location
82	-87.884	38.4658	11.89	4/21/2008	-112	4:13:27	CERI location
83	-87.8893	38.4502	19.05	4/21/2008	-112	4:33:35	CERI location
84	-87.8782	38.4533	15.2	4/21/2008	-112	5:38:31	CERI location
85	-87.8675	38.4538	10.85	4/21/2008	-112	7:58:46	CERI location
86	-87.8697	38.4498	18.36	4/21/2008	-112	8:37:17	CERI location
87	-87.8825	38.4535	17.26	4/21/2008	-112	8:56:41	CERI location
88	-87.8793	38.4585	17.43	4/21/2008	-112	8:59:39	CERI location
89	-87.8825	38.4495	15.42	4/21/2008	-112	9:45:12	CERI location
90	-87.8843	38.4535	17.28	4/21/2008	-112	10:12:31	CERI location
91	-87.8483	38.4438	16.51	4/21/2008	-112	11:47:15	CERI location
92	-87.8767	38.4517	16.52	4/21/2008	-112	15:14:47	CERI location
93	-87.8758	38.4518	17.48	4/21/2008	-112	17:39:33	CERI location
94	-87.866	38.4543	15.72	4/21/2008	-112	18:26:36	CERI location
95	-87.891	38.455	15.29	4/21/2008	-112	19:08:24	CERI location
96	-87.8945	38.4328	16.66	4/21/2008	-112	20:03:56	CERI location
97	-87.8817	38.4652	8.06	4/21/2008	-112	20:20:25	CERI location
98	-87.8765	38.437	17.1	4/21/2008	-112	22:30:31	CERI location
99	-87.8942	38.4345	15.08	4/22/2008	-113	7:33:48	CERI location
100	-87.857	38.424	21.61	4/22/2008	-113	7:42:32	CERI location
101	-87.8677	38.4535	14.87	4/22/2008	-113	7:43:39	CERI location
102	-87.8733	38.4643	7.41	4/22/2008	-113	8:01:01	CERI location
103	-87.874	38.4577	15.14	4/22/2008	-113	8:32:26	CERI location
104	-87.8823	38.4567	14.66	4/22/2008	-113	8:38:53	CERI location
105	-87.8598	38.4513	15.34	4/22/2008	-113	10:46:23	CERI location
106	-87.8512	38.4487	15.47	4/22/2008	-113	13:48:20	CERI location
107	-87.8498	38.45	11.45	4/23/2008	-114	1:32:34	CERI location
108	-87.8515	38.4745	11.99	4/23/2008	-114	5:52:54	CERI location

109	-87.892	38.4643	12.98	4/23/2008	-114	10:44:59	CERI location
110	-87.874	38.4458	14.9	4/23/2008	-114	16:23:56	CERI location
111	-87.8837	38.4523	13.91	4/23/2008	-114	19:27:31	CERI location
112	-87.8735	38.4482	13.62	4/23/2008	-114	21:22:18	CERI location
113	-87.8723	38.455	15.43	4/24/2008	-115	5:56:43	CERI location
114	-87.8618	38.4572	16.73	4/24/2008	-115	10:23:52	CERI location
115	-87.8708	38.4427	14.76	4/24/2008	-115	11:44:25	CERI location
116	-87.883	38.4518	13.33	4/24/2008	-115	15:38:58	CERI location
117	-87.8998	38.4385	14.27	4/24/2008	-115	22:08:10	CERI location
118	-87.8483	38.453	16.14	4/25/2008	-116	0:11:07	CERI location
119	-87.8605	38.4508	15.85	4/25/2008	-116	1:49:13	CERI location
120	-87.8728	38.449	14.95	4/25/2008	-116	5:08:48	CERI location
121	-87.872	38.4565	17.9	4/25/2008	-116	7:32:12	CERI location
122	-87.8688	38.4485	17.2	4/25/2008	-116	10:15:48	CERI location
123	-87.8532	38.4508	15.86	4/25/2008	-116	15:28:11	CERI location
124	-87.881	38.4537	14.17	4/25/2008	-116	17:31:01	CERI location
125	-87.8825	38.456	14.17	4/25/2008	-116	17:38:32	CERI location
126	-87.9017	38.4525	16.97	4/25/2008	-116	18:52:54	CERI location
127	-87.9063	38.4388	13.81	4/25/2008	-116	23:00:46	CERI location
128	-87.8813	38.4525	15.85	4/26/2008	-117	1:06:52	CERI location
129	-87.849	38.4487	17.15	4/26/2008	-117	4:45:36	CERI location
130	-87.8833	38.461	18.16	4/26/2008	-117	12:35:33	CERI location
131	-87.9092	38.4417	13.96	4/26/2008	-117	13:23:12	CERI location
133	-87.868	38.4532	16.54	4/26/2008	-117	20:14:46	CERI location
134	-87.8638	38.4483	17.17	4/27/2008	-118	1:34:20	CERI location
135	-87.8332	38.441	17.88	4/27/2008	-118	2:33:13	CERI location
136	-87.8675	38.449	15.03	4/27/2008	-118	4:52:31	CERI location
137	-87.8583	38.452	15.11	4/27/2008	-118	8:08:23	CERI location
138	-87.859	38.4507	13.25	4/27/2008	-118	8:26:58	CERI location

139	-87.8955	38.4433	14.2	4/27/2008	-118	8:57:28	CERI location
140	-87.8383	38.4408	16.68	4/27/2008	-118	11:25:02	CERI location
141	-87.8183	38.4322	17.6	4/27/2008	-118	12:05:17	CERI location
142	-87.883	38.458	15.01	4/27/2008	-118	16:48:19	CERI location
143	-87.8517	38.4457	16.72	4/27/2008	-118	16:49:13	CERI location
144	-87.8655	38.4542	16.65	4/27/2008	-118	23:01:21	CERI location
145	-87.8958	38.436	12.97	4/28/2008	-119	6:39:27	CERI location
146	-87.8938	38.4632	14.13	4/28/2008	-119	6:55:55	CERI location
147	-87.8482	38.447	12.16	4/28/2008	-119	7:35:45	CERI location
148	-87.8668	38.4513	16.89	4/28/2008	-119	9:20:56	CERI location
149	-87.852	38.448	14.5	4/28/2008	-119	21:46:59	CERI location
150	-87.9068	38.4563	17.01	4/29/2008	-120	5:24:56	CERI location
151	-87.8612	38.4525	15.3	4/30/2008	-121	4:24:48	CERI location
152	-87.8748	38.451	16.99	4/30/2008	-121	17:27:37	CERI location
153	-87.8673	38.4547	16.57	4/30/2008	-121	19:29:19	CERI location
154	-87.8653	38.4467	14.31	4/30/2008	-121	20:25:28	CERI location
155	-87.8475	38.4475	15.06	5/1/2008	-122	0:53:34	CERI location
156	-87.8648	38.4537	17.05	5/1/2008	-122	5:30:38	CERI location
157	-87.8325	38.448	17.42	5/1/2008	-122	6:22:25	CERI location
158	-87.8612	38.4493	16	5/1/2008	-122	20:10:56	CERI location
159	-87.8685	38.4555	13.69	5/2/2008	-123	4:13:32	CERI location
160	-87.8633	38.4525	16.03	5/2/2008	-123	11:39:18	CERI location
161	-87.8448	38.4468	13.69	5/3/2008	-124	0:34:20	CERI location
162	-87.9112	38.446	17.3	5/3/2008	-124	3:18:59	CERI location
163	-87.8737	38.4577	15.68	5/3/2008	-124	14:21:54	CERI location
164	-87.892	38.4328	12.98	5/3/2008	-124	14:42:43	CERI location
165	-87.894	38.4423	12.04	5/5/2008	-126	8:17:05	CERI location
166	-87.8602	38.4458	13.1	5/5/2008	-126	14:56:09	CERI location
167	-87.871	38.4553	14.67	5/5/2008	-126	17:56:56	CERI location

168	-87.8663	38.4488	16.2	5/6/2008	-127	7:55:07	CERI location
169	-87.8678	38.4487	15.51	5/6/2008	-127	7:57:03	CERI location
170	-87.8387	38.4435	17.63	5/6/2008	-127	13:21:55	CERI location
171	-87.8795	38.453	14.74	5/9/2008	-130	14:43:42	CERI location
172	-87.858	38.4487	16.4	5/10/2008	-131	11:57:40	CERI location
173	-87.8673	38.45	13.03	5/16/2008	-137	3:46:11	CERI location
174	-87.8795	38.4568	14.53	5/19/2008	-140	4:07:24	CERI location
175	-87.8517	38.4532	14.19	6/1/2008	-153	14:56:12	CERI location
8	-87.8436	38.4426	17.0909	4/18/2008	-109	10:44:10	locsat:iasp91
9	-87.8781	38.4463	18.8055	4/18/2008	-109	10:46:23	locsat:iasp91
20	-87.8988	38.4359	12.19	4/19/2008	-110	3:05:53	locsat:iasp91
2	-87.8505	38.4666	13.9126	4/18/2008	-109	10:04:00	pmelavg
3	-87.9152	38.4469	10.0742	4/18/2008	-109	10:06:07	pmelavg
5	-87.9279	38.4875	39.8094	4/18/2008	-109	10:15:36	pmelavg
8	-87.8409	38.4727	13.362	4/18/2008	-109	10:44:11	pmelavg
11	-87.9208	38.4653	11.695	4/18/2008	-109	11:25:26	pmelavg
12	-87.8896	38.4513	11.089	4/18/2008	-109	11:55:58	pmelavg
13	-87.8987	38.4778	15.2133	4/18/2008	-109	15:14:17	pmelavg
14	-87.8818	38.4455	13.2326	4/18/2008	-109	23:14:33	pmelavg
15	-87.8527	38.4537	14.4034	4/18/2008	-109	23:44:04	pmelavg
16	-87.8678	38.44	9.7661	4/18/2008	-109	23:46:56	pmelavg
17	-87.8713	38.4458	10.53	4/19/2008	-110	2:19:53	pmelavg
18	-87.8598	38.4535	14.1762	4/19/2008	-110	2:33:01	pmelavg
19	-87.8458	38.4734	10.4952	4/19/2008	-110	2:35:54	pmelavg
20	-87.8801	38.4385	8.4415	4/19/2008	-110	3:05:54	pmelavg
21	-87.8954	38.4479	12.2857	4/19/2008	-110	3:09:14	pmelavg
24	-87.8841	38.4588	14.2181	4/19/2008	-110	3:37:09	pmelavg
25	-87.876	38.449	12.1603	4/19/2008	-110	3:48:06	pmelavg
26	-87.8604	38.4554	10.9402	4/19/2008	-110	3:50:16	pmelavg

27	-87.8513	38.4504	10.4803	4/19/2008	-110	3:55:52	pmelavg
28	-87.8983	38.4417	12.0644	4/19/2008	-110	3:59:41	pmelavg
29	-87.8602	38.4555	11.8842	4/19/2008	-110	4:27:42	pmelavg
31	-87.8591	38.4508	9.8731	4/19/2008	-110	6:50:44	pmelavg
33	-87.8525	38.4491	10.1828	4/19/2008	-110	7:38:02	pmelavg
34	-87.8496	38.4461	11.6518	4/19/2008	-110	7:49:45	pmelavg
35	-87.8798	38.4586	13.7819	4/19/2008	-110	8:25:08	pmelavg
37	-87.8626	38.4529	13.1959	4/19/2008	-110	10:06:59	pmelavg
42	-87.8639	38.4549	11.1388	4/19/2008	-110	12:46:44	pmelavg
43	-87.8693	38.4558	12.5977	4/19/2008	-110	13:08:57	pmelavg
47	-87.8777	38.454	13.6152	4/19/2008	-110	19:03:37	pmelavg
48	-87.8717	38.4539	10.9395	4/19/2008	-110	19:28:52	pmelavg
50	-87.8588	38.4571	11.1197	4/19/2008	-110	21:03:11	pmelavg
51	-87.8591	38.4671	13.452	4/19/2008	-110	22:04:40	pmelavg
52	-87.8649	38.4569	11.2317	4/19/2008	-110	23:31:24	pmelavg
53	-87.8676	38.4542	9.9912	4/19/2008	-110	23:33:50	pmelavg
54	-87.858	38.4487	11.7139	4/20/2008	-111	1:19:30	pmelavg
55	-87.8445	38.442	11.5327	4/20/2008	-111	2:17:28	pmelavg
57	-87.8759	38.4538	11.2734	4/20/2008	-111	4:35:29	pmelavg
58	-87.9074	38.4462	15.6183	4/20/2008	-111	4:45:58	pmelavg
59	-87.8418	38.4491	13.4145	4/20/2008	-111	5:02:42	pmelavg
60	-87.8937	38.4442	11.0479	4/20/2008	-111	5:09:43	pmelavg
61	-87.8634	38.458	11.085	4/20/2008	-111	5:21:50	pmelavg
62	-87.8799	38.4598	10.6954	4/20/2008	-111	5:31:43	pmelavg
64	-87.8541	38.4501	14.1857	4/20/2008	-111	7:42:33	pmelavg
66	-87.8622	38.4655	12.3165	4/20/2008	-111	9:59:45	pmelavg
68	-87.8916	38.4665	15.4849	4/20/2008	-111	15:51:12	pmelavg
69	-87.8967	38.4534	15.2726	4/20/2008	-111	18:16:45	pmelavg
72	-87.8463	38.4486	13.2583	4/20/2008	-111	20:37:46	pmelavg

73	-87.8983	38.4455	14.263	4/20/2008	-111	20:54:04	pmelavg
74	-87.8827	38.4674	12.6562	4/20/2008	-111	21:38:42	pmelavg
75	-87.8645	38.4556	13.373	4/20/2008	-111	22:30:42	pmelavg
76	-87.8667	38.4539	13.6057	4/20/2008	-111	23:05:13	pmelavg
80	-87.8587	38.4646	11.7222	4/21/2008	-112	4:05:56	pmelavg
81	-87.8584	38.4539	14.1511	4/21/2008	-112	4:11:21	pmelavg
82	-87.8835	38.4588	11.8346	4/21/2008	-112	4:13:27	pmelavg
85	-87.87	38.4569	12.3745	4/21/2008	-112	7:58:46	pmelavg
87	-87.8751	38.4665	13.7683	4/21/2008	-112	8:56:41	pmelavg
88	-87.8905	38.4564	14.62	4/21/2008	-112	8:59:39	pmelavg
89	-87.882	38.4503	14.5728	4/21/2008	-112	9:45:12	pmelavg
91	-87.8516	38.4465	12.9829	4/21/2008	-112	11:47:15	pmelavg
92	-87.8753	38.4512	14.4498	4/21/2008	-112	15:14:48	pmelavg
95	-87.8952	38.462	12.9775	4/21/2008	-112	19:08:25	pmelavg
96	-87.8995	38.437	14.0607	4/21/2008	-112	20:03:56	pmelavg
98	-87.8834	38.4409	14.8426	4/21/2008	-112	22:30:32	pmelavg
99	-87.8967	38.4306	13.8795	4/22/2008	-113	7:33:48	pmelavg
100	-87.901	38.4421	14.5615	4/22/2008	-113	7:42:33	pmelavg
101	-87.8624	38.4499	11.2103	4/22/2008	-113	7:43:40	pmelavg
102	-87.8836	38.4594	7.5003	4/22/2008	-113	8:01:01	pmelavg
103	-87.8791	38.4581	13.5075	4/22/2008	-113	8:32:26	pmelavg
104	-87.8917	38.453	15.1593	4/22/2008	-113	8:38:53	pmelavg
105	-87.8618	38.4488	13.1447	4/22/2008	-113	10:46:23	pmelavg
106	-87.8513	38.4518	11.1495	4/22/2008	-113	13:48:20	pmelavg
107	-87.8595	38.4486	11.279	4/23/2008	-114	1:32:34	pmelavg
108	-87.86	38.49	12.0367	4/23/2008	-114	5:52:54	pmelavg
111	-87.8807	38.4493	10.1182	4/23/2008	-114	19:27:32	pmelavg
112	-87.8724	38.453	9.7284	4/23/2008	-114	21:22:19	pmelavg
113	-87.8708	38.4577	13.5683	4/24/2008	-115	5:56:43	pmelavg

114	-87.8657	38.4553	12.7709	4/24/2008	-115	10:23:52	pmelavg
116	-87.8916	38.4606	11.4287	4/24/2008	-115	15:38:59	pmelavg
119	-87.8615	38.4508	12.5897	4/25/2008	-116	1:49:13	pmelavg
120	-87.874	38.4548	11.588	4/25/2008	-116	5:08:49	pmelavg
121	-87.8783	38.4586	14.9787	4/25/2008	-116	7:32:13	pmelavg
122	-87.8648	38.4485	14.2841	4/25/2008	-116	10:15:49	pmelavg
123	-87.8515	38.4481	12.2131	4/25/2008	-116	15:28:11	pmelavg
124	-87.8788	38.4559	13.8596	4/25/2008	-116	17:31:01	pmelavg
125	-87.887	38.4582	12.4594	4/25/2008	-116	17:38:33	pmelavg
128	-87.8404	38.4684	11.7679	4/26/2008	-117	1:06:52	pmelavg
129	-87.8506	38.4512	13.8787	4/26/2008	-117	4:45:37	pmelavg
132	-87.8762	38.4558	14.5617	4/26/2008	-117	15:00:51	pmelavg
133	-87.8694	38.4563	14.0914	4/26/2008	-117	20:14:46	pmelavg
134	-87.8726	38.448	13.9602	4/27/2008	-118	1:34:21	pmelavg
135	-87.845	38.442	13.2842	4/27/2008	-118	2:33:14	pmelavg
136	-87.8653	38.4538	10.5086	4/27/2008	-118	4:52:32	pmelavg
137	-87.8694	38.4523	15.4951	4/27/2008	-118	8:08:23	pmelavg
138	-87.8852	38.4681	12.8841	4/27/2008	-118	8:26:58	pmelavg
139	-87.8882	38.4354	11.2238	4/27/2008	-118	8:57:29	pmelavg
141	-87.8539	38.4482	13.5194	4/27/2008	-118	12:05:18	pmelavg
142	-87.8887	38.4583	12.4246	4/27/2008	-118	16:48:19	pmelavg
143	-87.8742	38.4541	12.8782	4/27/2008	-118	16:49:13	pmelavg
144	-87.868	38.4536	12.4883	4/27/2008	-118	23:01:22	pmelavg
146	-87.8929	38.4648	11.5615	4/28/2008	-119	6:55:56	pmelavg
147	-87.8533	38.4493	11.6299	4/28/2008	-119	7:35:46	pmelavg
149	-87.8544	38.4493	10.9338	4/28/2008	-119	21:47:00	pmelavg
151	-87.8606	38.4555	11.2349	4/30/2008	-121	4:24:49	pmelavg
154	-87.8659	38.4492	11.9368	4/30/2008	-121	20:25:29	pmelavg
155	-87.8507	38.4474	10.8207	5/1/2008	-122	0:53:35	pmelavg

156	-87.8682	38.4568	16.4272	5/1/2008	-122	5:30:38	pmelavg
157	-87.8305	38.4498	13.8549	5/1/2008	-122	6:22:25	pmelavg
158	-87.869	38.4514	12.4687	5/1/2008	-122	20:10:56	pmelavg
159	-87.8726	38.4611	11.0381	5/2/2008	-123	4:13:32	pmelavg
161	-87.8543	38.4654	13.673	5/3/2008	-124	0:34:20	pmelavg
163	-87.8625	38.4638	10.2939	5/3/2008	-124	14:21:55	pmelavg
165	-87.9072	38.4516	11.2726	5/5/2008	-126	8:17:05	pmelavg
166	-87.8749	38.4556	11.3923	5/5/2008	-126	14:56:10	pmelavg
167	-87.8663	38.4538	10.5472	5/5/2008	-126	17:56:57	pmelavg
168	-87.8695	38.4561	13.8225	5/6/2008	-127	7:55:07	pmelavg
169	-87.8697	38.4559	12.3487	5/6/2008	-127	7:57:04	pmelavg
170	-87.8675	38.455	13.5135	5/6/2008	-127	13:21:55	pmelavg
171	-87.8737	38.4574	10.1462	5/9/2008	-130	14:43:43	pmelavg
172	-87.8681	38.4544	14.2497	5/10/2008	-131	11:57:40	pmelavg
174	-87.8792	38.4609	12.7592	5/19/2008	-140	4:07:25	pmelavg
175	-87.8608	38.4544	14.025	6/1/2008	-153	14:56:12	pmelavg
183	-87.8477	38.4446	8.9666	4/19/2008	-110	9:46:44	pmelavg
187	-87.9004	38.4659	12.7715	4/19/2008	-110	13:17:26	pmelavg